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CONTRIBUTIONS TO BOTANY,

ICONOGRAPHIC AND DESCRIPTIVE,

DETAILING

THE CHARACTERS OF PLANTS THAT ARE EITHER NEW
OR IMPERFECTLY DESCRIBED;

TO WHICH ARE ADDED

REMARKS ON THEIR AFFINITIES.

BY

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ET REG. SOC. BOT. RATISB. SOCIUS.

VOL. II.

WILLIAMS AND NORGATE,
14, HENRIETTA STREET, COVENT GARDEN, LONDON;
AND
20, SOUTH FREDERICK STREET, EDINBURGH.

1860 TO 1869.

PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.

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PREFACE.

THE text which forms this volume consists of reprints of the several papers contributed by me to the 'Annals of Natural History,' wherein they appeared at intervals extending over a period between September 1860 and May 1869: these are now here collected, revised, and accompanied by the plates intended to illustrate the subjects referred to. Among them will be found a monograph of the *Calyceraceæ*, with analyses of the peculiar structure of that family; also observations on the carpical structure, organization, and affinities of the *Bignoniaceæ* and *Crescentiaceæ*, followed by descriptions of the genera *Adenocalymna* and *Tanaecium*, and of some of their species. At the time these were made, I had carefully examined and defined the limits of most of the genera of that family, intending to continue their publication thus commenced; but I suddenly desisted, out of respect to Dr. Seemann, who I learned was then engaged in a similar task. In 1863, however, I furnished an outline of some of my proposed genera and species, in the 'Proceedings of the Royal Horticultural Society' for that year, on the occasion of determining the Bignoniaceous plants collected in Brazil by Mr. Weir for that Society. Finally I thought it would best serve the interests of science to hand over all my notes, drawings, analyses, and specimens to M. Bureau, who has been for some time engaged in preparing an elaborate monograph of the *Bignoniaceæ* for the great work, the 'Flora Brasiliensis.' In the meanwhile my memoir on *Crescentia* has appeared in the 'Linnean Transactions.'

As there was much uncertainty about the plants actually employed in the production of the celebrated Maté, or Paraguay Tea, a noted article of commerce still extensively consumed in Brazil, Paraguay, the several Argentine provinces, Chile, Peru, and Bolivia, in the same way that the Tea of China is used in Europe, I succeeded in obtaining from the renowned Bonpland, who resided many years in Paraguay, authentic specimens of these plants, verified by his own handwriting: these typical plants, as well as those employed in Brazil, are here described and figured, together with some other genera of the *Aquifoliaceæ* allied to them.

The genus *Goupia*, the structure of which was not well understood, is here figured, with a complete analysis, and its affinities considered.

All the South-American forms of *Ephedra* known to me are here also figured and described, and careful analytical details of the structure of this genus are shown. A review is also given of the opinions of different botanists in regard to the structure and affinities of the *Gnetaceæ*, and numerous facts are offered to invalidate the views of those who place the family among true Gymnosperms. I have endeavoured to show that *Ephedra* cannot be regarded as a Gymnosperm under any legitimate point of view, particularly as it has neither naked ovules nor naked seeds, and as by its organization it can only be considered very distantly allied to *Coniferæ* and *Cycadaceæ*. I have pointed out that it has a calycine development assuming the form of an involucre, a regular petaloid perigonium (or tubular corolla), and determinate monadelphous stamens in the male flowers; while the female flowers have a similar calycine development, the ultimate pair containing two ovaries, with a depressed style and an open stigma, each, when matured, producing a fruit with a coriaceous pericarp enclosing a single albuminous embryonary seed covered by two distinct integuments. This organization has ample claims to be considered truly exogenous, exhibiting a far higher order of development than the *Coniferæ*, *Cycadaceæ*, or even *Myricaceæ* and other amental orders, approaching in these respects nearer to *Urticaceæ*, with which it agrees in many correlative features, notably in the presence of cystoliths or spicular fibres in its leaves and involucres. These considerations have been wholly ignored by the distinguished author of the Gymnospermous orders in a recent volume of the 'Prodromus' of De Candolle, where their organization is expounded upon the very limited views of the older botanists. The many striking points of analogy between *Ephedra* and *Casuarina,* especially in their habit and floral structure, are here sufficiently indicated to show the considerable degree of affinity that exists between them: the details of the seminal structure of *Casuarina,* which I analyzed with great care, will, I think, be found more correct than the description lately given by Prof. Miquel in the same volume of the 'Prodromus.'

I have also contributed a monograph of the *Tricuspidarieæ.*

Many details are given towards a knowledge of the structure of the *Heliotropiaceæ,* a description of the new genus *Cochranea* being added and the hitherto doubtful genus *Messerschmidtia* defined.

In succession the various South-American forms of the *Ehretiaceæ* have been carefully analyzed, especially with regard to their carpical organization and the peculiar development of the ovary and seeds; at the same time the characters of the several genera are amply described, and illustrated by separate drawings.

The next or third volume of these 'Contributions' will be wholly occupied by my Monograph of the *Menispermaceæ,* which has now been some time in type, awaiting the completion of about sixty-five plates, in illustration of the peculiar structure of each genus of that family.

84 Addison Road, Kensington.
October 1869.

CONTRIBUTIONS TO BOTANY.

ON THE CALYCERACEÆ.

THE small order of the *Calyceraceæ* is little known : it is, however, of great interest to the systematic botanist, because it constitutes the connecting link between the extensive family of the *Compositæ* and the contiguous orders of the *Dipsaceæ* and *Valerianaceæ.* It exhibits also many points of structure which are exceedingly curious.

It was first instituted as a distinct family by Mr. Robert Brown, under the title of the *Calycereæ,* in a memoir read before the Linnæan Society in Feb. 1816, when, with his extraordinary acumen, that most distinguished of botanists was able to determine, from very incomplete specimens, its principal and most essential characters. Nearly about the same time, Cassini, while engaged in numerous investigations in the family of the *Compositæ,* noticed, in the genera *Calycera* and *Boopis,* a considerable difference of structure; he therefore separated them into a small order, for which he proposed the name of *Boopidæ.* This memoir was read before the French Academy in August of the same year.

From the admirable remarks of Mr. Brown on this subject *, and the subsequent very complete analysis by M. Richard, in 1820 †, of the whole family, which then consisted of only five species, representing three genera, we possess nearly all the information hitherto published respecting the structure of the order. A few years later (in 1831) Lessing described two new species from Sellow's Brazilian collections, and also two others brought from Chile by Pöppig: the characters of these last were afterwards given in fuller detail by Pöppig himself in 1835 *.

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* Linn. Trans. xii. p. 135.

† Mém. Mus. vi. p. 75.

These descriptions added nothing to our previous knowledge of the structure of the order. DeCandolle, in the following year (1836), gave, in his 'Prodromus,' a monograph of the whole family, and in a very succinct manner gave the characters of the ten species (all then known), which he arranged under four genera. Some years ago, I proposed the genus *Nastanthus*, the type of which I found in the Cordillera of Chile in 1825, and of which I then made a drawing with structural details; since then I have added ten other species to this genus. I also indicated the existence of another new genus, *Anomocarpus*, which I had long before founded upon a plant of Cuming's collection in Chile, to which I now add six other species. The genus *Leucocera* of Turczaninow† is inadmissible, as it rests only upon a species of *Boopis* previously described by Pöppig and Lessing. In the same manner, the *Acarpha* of Dr. Grisebach ‡ must be referred to *Boopis*, and the *Gymnocaulus* § of Dr. Philippi to *Calycera*, upon grounds that will presently be shown.

The *Calyceraceæ* have many characters in common with the *Compositæ*. Their flowers, often intermixed with setaceous paleæ, are aggregated upon a general receptacle, which is enclosed within an involucre of bracteiform leaflets more or less combined in one series: the ovary is constantly inferior; the calyx, which is adnate to it, has a free, generally 5-toothed border; the corolla is tubular, the lobes of its border being valvate in æstivation, and possessing the same peculiar system of nervation as the *Compositæ*; their anthers, in like manner, are syngenesious; their ovary is also inferior, 1-celled, and 1-ovular; and the fruit is a dry achænium surmounted by the indurated and enlarged teeth of the calyx. They differ essentially, however, in the structure of the ovary, the ovule being suspended from the apex of the cell (not erect); in their achænia being crowned by the calycine teeth, often elongated into rigid spines (not surmounted by a pappus); in their seeds containing a copious albumen, and a terete embryo, the radicle of which usually exceeds the cotyledons in length, the radicle pointing to the apex of the cell (not to its base); their anthers, too, are deficient of the apical expansion of the connective, usually found in *Compositæ*.. They are all herbaceous plants, natives of South America, mostly growing in elevated and arid situations in the Andes of Chile;

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* Nov. Gen. et Spec. i. p. 21, tab. 33 & 34.

† Bot. Zeitung, xxxi. p. 712.

‡ Diagn. Pl. Lechler, p. 38.

§ Linnæa, xxviii. p. 705.

two species extend into the Cordillera of Peru; three are found near the Straits of Magellan; seven others on the eastern portion of the continent, bordering on the Rio de la Plata and the Rio Grande; and another extending beyond the line of the Southern Tropic, growing along the sea-shore of Rio de Janeiro, and as far to the northward as Bahia.

Some points of their structure are yet considered to be ambiguous, opposite views in regard to them having been held by Brown and Richard, which I will endeavour to reconcile and explain. The stamens, always equal in number to, and alternate with the segments of the corolla, have their anthers free at their summits, but confluent by their margins towards their base into a syngenesious ring: the summits of the five filaments are quite free, but are combined below into a cylinder, which is adnate to the tube of the corolla above its middle, while the base of this tube is seated upon a prominence which crowns the summit of the ovary, and bears the style. Upon the tube of the corolla, just below the apparent attachment of the free portion of the filamentous ring, are seen five coloured fleshy glands, alternating with the stamens. Mr. Brown remarks * that this and other peculiar characters distinguish the *Calyceraceæ* from the hermaphrodite flowers of the whole order of the *Compositæ*: viz. "*the accretion of the base of the style* with the tube of the corolla," "*the absence of the epigynous disk* or nectarium," and the perfectly unilocular space of the anther-lobes; besides these, the corolla is continuous with, and not jointed to, the ovarium; the anthers are deficient of any membranaceous expansion of their summits, and the stigma is constantly undivided. Mr. Brown further remarks that, in *Calyceraceæ*, "the absence of an epigynous disk is a necessary consequence of the accretion of the base of the style with the tube of the corolla;" and it appeared to him that "a modification of the same organ may be traced in the five thickened areolæ observable within and near the base of the tube formed by the filaments in *Acicarpha spathulata*, and much more distinctly in *Boopis balsamitæfolia*, where they have the appearance of five adnate fleshy bodies alternating with the filaments †:" he adds that the condition above alluded to "may be considered as formed of a series of modified stamina."

M. Richard, in his admirable memoir before mentioned, combated with great ingenuity the opinion of Mr. Brown, and maintained ‡ that this "accretion of the base of the style with the tube of the corolla," and "the absence of an epigynous disk or nectarium," are contradictory definitions. He endeavoured to show that the apical protuberance in question is a true epigynous disk; or, if it be not rigorously demonstrated to be a true disk, it bears at least the closest analogy with that organ, for it appears to supply its place*.

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* Linn. Trans. xii. p. 137.

† Linn. Trans. xii. p. 140.

‡ Mém. Mus. vi. p. 67.

Whatever be the nature of the glandular areoles, a careful examination of the whole structure leads me to conclude that they belong to the region of the staminal tube, and not to that of the corolla, as Richard was inclined to believe, referring to *Echinops*, by way of analogy, where similar areolar glands exist in the bottom of the border of the corolla. In *Calycera* and *Boopis*, as examined by Brown and Richard, where these bodies appear on the tube of the corolla, below the point of apparent insertion of the filamentous ring, we easily ascertain the truth by laying hold of any portion of this ring, and tearing it away downwards from the corolla: we find the arcolar glands come away with the filaments, showing that they form no part of the corolla. This fact is further established beyond doubt in *Nastanthus* and *Anomocarpus*, where the same glands are found seated upon the free portion of the filamentous ring, above the point of its insertion upon the corolla.

In regard to the prominent tubercle which crowns the ovary in all the *Calyceraceæ*, which Richard held to be a disk, all that I have seen tends to a conclusion at variance with the precept of Mr. Brown, which attributes to the flower in this family, as its essential character, "the absence of an epigynous disk," and, as "a necessary consequence" of this character, "the accretion of the base of the style to the base of the corolla." We have strong presumptive evidence of the actual presence of an epigynous disk, analogous to that in *Compositæ*; and it may be inferred that the "accretion" above mentioned arises from its intervention and confluence, both with the base of the style which it surrounds, and with the tube of the corolla, over the inner surface of which it is spread to a considerable extent, so that when the corolla falls off we always find the bottom of the tube closed, as if by a plug, owing to its presence. The nature of the five areolar glands is somewhat connected with this consideration: they are always alternate with the stamens; and their origin may be attributed to two sources: either they may be viewed, as Mr. Brown regarded them, as a row of additional abortive stamens; or they may be considered as glandular protuberances appertaining to a disk extended, in the manner above mentioned, over the inner surface of the tube of the corolla. The former view will not stand the test of analogy, when compared with the numerous and varied developments seen in the neighbouring order *Compositæ;* and the latter suggestion may be adopted without having recourse to the idea that the glands are "a series of modified stamens." In regard to the existence of such a disk as I have suggested, we have some evidence in *Nastanthus,* where we find the usual confluence of the lower half of the staminal filaments into a monadelphous tube (*tubillus* of Richard), which soon becomes adnate to the tube of the corolla: we find in the mouth of this "tubillus" an internal row of minute, free, linear hyaline teeth, alternating with the upper or free portions of the filaments, rounded at their apex, and connected together by an acute sinus; they evidently form an inner whorl with the filaments, and do not intervene between them. These teeth bear more the semblance of abortive stamens than the areolar glands; but the same reasoning which leads to the rejection of such a nature for the one will deny it to the other. We may with greater probability consider these teeth as constituting the margin of such an adnate disk as I have suggested, the presence of which is supported by much collateral evidence; and we may moreover, with great reason, attribute to the existence of this disk the cause of the confluence of a portion of the filaments into a "tubillus," or monadelphous ring, while all the portions of the same filaments beyond the limit of the disk remain free. In *Acicarpha,* where the disk appears to be carried up to the extremity of the filaments, so that they are entirely monadelphous, there is seen a thickening, called by Richard an "*epinema,*" which may be conceived to be the margin of the disk, and which gives the anthers the appearance of being articulated upon the filaments; but this does not occur in the other genera of the family, where the filaments are free at their apex.

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* Mém. Mus. vi. p. 72.

Although in *Calyceraceæ* the corolla at length falls off from the summit of the apical tubercle of the seed, the fact cannot be denied (as was demonstrated by Richard and confirmed by Brown), that the tube of the corolla, in all stages, is continued downwards over the entire surface of that tubercle. If we cut through any *Calyceraceous* achænium before the fall of the corolla, by a longitudinal section, we find that this tubercle consists externally of such a continuation of the corolla, lined with an intermediate fibrous stratum, having in the centre a thickish white cylindrical cord, continuous with the style, and all three are agglutinated into one body. It is from the bottom of this cord that the seed is suspended, by a short funicle, in the summit of the cell. This cord can neither be considered as a portion of the funicle, which is continuous with it, nor as a part of the style, although it is articulated with the latter and also continuous with it; it is, in truth, the placentary development destined to give origin to the suspended ovule.

The seed in *Nastanthus* is deeply 5-grooved, its salient lobes corresponding to and continuous with the round and concave teeth of the calyx. If we make a transverse section across the achænium, we find in the bottom of these grooves no mesocarpic space between the thin endocarp and epicarp; so that the external diameter of the seed in that part little exceeds that of the apical tubercle; but the salient lobes or wings, which extend from the calycine teeth to the base, are often more than thrice that diameter; and the space between the epicarp and endocarp in these wings is filled with a pithy medulla, no trace of which exists in the intervals of the grooves. There are seen in this section ten very distinct longitudinal nerves upon the endocarp, five of which are opposite the grooves, the other five being alternately placed opposite the wings, all of them at equal distances: in the longitudinal section these ten nerves are seen to run parallel to one another from the base to the apex, and to pass through the apical tubercle, forming the intermediate fibrous stratum above mentioned. At the summit they all seem combined in a plexus, whence are thrown out the nourishing threads to the placental cord for the support of the ovule and for the production of the raphe; while other portions branch off through the style and the epigynous disk, thus giving rise to the nervures of tracheal vessels destined to assist in the growth of the stamens, and also furnishing the longitudinal nervures of the corolla. We thus perceive the nature and function of the apical tubercle, and can well imagine how the corolla falls away at a very late period, by a circumscissile line across the plexus, and also why it carries away the disk with it.

In the *Calyceraceæ* the segments of the corolla always alternate with the lobes of the calyx, and the stamens, again, reciprocate with those segments. The tube of the corolla is furnished with ten parallel nervures, originating at the base, as above described, five running through the median line of the segments and terminating in a gland at their apex, the other five alternating with them, and nearly reaching the angle of each sinus, before which they bifurcate and throw off on each side a nervure, which runs parallel with each margin of the segments, and all anastomose with the median nerves at their termination. I have mentioned that the "tubillus," consisting of the united filaments and the disk, though agglutinated below to the tube of the corolla, may be separated throughout the whole length of this confluence by laceration, when it appears furnished with five longitudinal nervures, which run from the base and through the free portions of the filaments to the anthers: these nervures are therefore opposite to the five shorter nerves of the corolla which lead to the sinus between every two segments; but, though apparently confounded, they are distinct from them, as shown when the "tubillus" is drawn away from the corolla.

There is a peculiarity of structure in *Nastanthus* and *Anomocarpus,* and, in a less degree, in most genera of the family, which is most distinctly visible in the polliniferous flowers of the two genera just mentioned:—the tube of the corolla and the segments of its border appear to consist of two distinct parallel laminæ, with a vacant space between them, as if the entire substance of a very thick mesoderm had disappeared by absorption or desiccation, leaving only a small quantity of cellular tissue consolidated in the apex of the segments, under the form of a glandular callus, which apical callus is a constant feature throughout the family. This separation of the two surfaces is greater in the segments than in the tube; the outer face is very convex, forming a prominent gibbous hood about the inner face, which is nearly flat: these two laminæ are perfectly united at the edges of the segments; the outer one is very thin, hyaline, reticulated, and contains no nervures; the inner one is more opake, coloured, and is furnished with the nervures above described. This structure is confirmed by the observation of Dr. Philippi (Linnæa, xxviii. 709) in his diagnosis of *Boopis* (*Nastanthus*) *Gayana* and of *Boopis* (*Nastanthus*) *compacta,* wherein he describes the corolla as being "breviter subcylindrica, membrana externa hyalina ab interiori viridi remota."

Another character of the *Calyceraceæ,* which serves to distinguish this family from the *Compositæ,* is deserving of some notice. Throughout the latter order, the style is bifid at its apex, and each branch is furnished towards its extremity with a stigmatic surface, and frequently also with collecting hairs, that assist in the transmission of the pollinic influence. On the contrary, in *Calyceraceæ* the style is undivided, clavate, and solid at the extremity, and, though here covered with a rugose surface, is quite deficient of any collecting hairs. Although the ovary in both cases is 1-locular, the inference may be drawn from the above circumstances, that the normal condition of the ovary in the one case is to be 2-ovular, and in the other 1-ovular; and though we have no positive proof of this conclusion, many circumstances tend to favour the opinion of the biovular tendency of the ovary in *Compositæ.* The placentary point of attachment of the solitary erect ovule is always upon one side of the base of the cell; and hence it may be assumed that, as there are two stigmata, another placentary point normally existed, which has been suppressed *: this idea is again confirmed by the fact that in many of the achænia of *Compositæ* two parallel grooves or longitudinal lines are seen upon the face opposite to the axis of the capitulum, which probably indicate the line of junction of two carpels, united there by their margins, without any introflexure or tendency towards forming a dissepiment; and it is probable that branches of the corda pistillaris from each stigmatic lobe run along these sutural edges of the carpels, as in the *Capparidaceæ* for instance. From the same circumstance we may also infer that the normal condition of the ovary is not 2-locular with an intervening dissepiment; for in such case the suppressed cell and the axis would be represented by a single longitudinal line. This inference is of course only hypothetical, but the suggestion is worthy of being kept in view.

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* A similar view has been advocated by Mr. B. Clarke (Ann. Nat. Hist. 2 ser. xi. p. 456).

In *Calyceraceæ* the flowers in the same capitulum are not all fertile; for many of them are sterile and polliniferous, which are promiscuously mixed with the fertile or hermaphrodite ones. In *Acicarpha*, however, there is some exception to this rule; for the superior or more central florets are all sterile, while the more external series are hermaphrodite and fertile.

I have observed in *Nastanthus*, where the florets are promiscuously intermixed, that the flowers first produced are not perfect; the tube of the corolla is considerably elongated into a very slender tube, on the outside of which are seen five prominences indicating the five transparent areolar glands, the tubillus within being very short, the filaments distinct, and the anther-cells, which are almost void of pollen, being almost, if not quite, free; the segments of the border are of much thinner consistence, and of a much greener hue: in these cases the globose stigma is fully developed on the summit of the clavate extremity of the long style, and the achænium yields a perfect seed. In the flowers last produced, and intermixed with the former, the tube of the corolla is thick, only half the length of the others, and so much thickened that the areolar glands become wholly immersed, and are not perceptible; and the segments of the border here exhibit the appearance of the gibbous double laminæ before described; the anthers, almost obsoletely polliniferous, are nearly free; the style is only slightly swollen at the apex, and deficient of the globose stigmatic expansion; the achænium, though attaining its full growth, does not always produce perfect seed; the corolla, in such instances, generally persists upon the achænium. Other flowers, again, are produced in an intermediate state, the achænium maturing its seed; but then the stigma is always fully developed, as well as the anthers, which are half united at their base into a syngenesious ring, and the corolla usually falls off soon after the period of impregnation.

In *Boopis*, *Gamocarpha*, and *Nastanthus*, the calycine lobes are deeply concave or semi-navicular, owing to their involution round the salient angles of the ovary, by which they become more or less hollow or tubular within, their median nervures being decurrent along the extreme angles of the ovary. When the seed is matured, these lobes, being acute in *Boopis*, become rigid at the point and acicular; in *Nastanthus* they remain rounded, thick, and obtuse; in *Calycera* and *Acicarpha*, where the lobes are flatter, they greatly enlarge, becoming subulate and rigid, and assume the form of very long, sharp, divaricate spines, of unequal length; in *Anomocarpus*, in the same capitulum, some of the achænia become spinescent, as in *Calycera*, while others retain the form of short rigid teeth, as in *Boopis*, both producing in like manner perfect seeds. In *Nastanthus* and *Anomocarpus*, and sometimes in *Boopis*, the surface of the epicarp is reticulated between the nervures with transverse, crowded, parallel and almost scalariform venations, the intervals often becoming swollen and assuming the appearance of transverse rugæ.

In *Calyceraceæ* the florets are all crowded upon a broad fleshy receptacle surrounded by an involucre, the leaflets of which are in a single series almost free from one another, in *Acicarpha*; accreted at the base upon a large fleshy receptacle in *Calycera* and *Nastanthus*; and confluent for the greater part of their length into a campanulate form in *Boopis* and *Anomocarpus*—thus remaining free from the receptacle, which is small and seated in its centre. In the five last-mentioned genera the receptacle is flat or slightly convex; in *Acicarpha* it is conical, globular, or cylindrical; in *Boopis* and *Anomocarpus* it is small and greatly reduced in size. Each capitulum is furnished with numerous crowded flowers; and in most of the genera, each floret is furnished at the point of its origin with a narrow elongated palea, as in *Compositæ*; but in *Anomocarpus* the receptacle is almost epaleaceous, each floret being inserted in an alveolar depression. In *Gamocarpha* the paleæ are conjoined in numerous circles, from their base half-way up their margins, the upper portions remaining free, and these again are united together by other paleæ, thus forming a kind of honeycomb structure, with deep cells or nests spread all over the receptacle, several florets being affixed to the bottom of each nest. There is some analogy in this respect with the structure in *Gundelia* among *Compositæ*, where there is a large capitulum, provided with a general involucre, which capitulum is composed of a great many tubular involucels with a spinosely dentate border, each containing 3–7 florets; the greater part of these involucels are agglutinated together in a honeycomb-like cylindrical head, and fixed upon an elongated central receptacle; these involucels may be considered as composed of two or more paleæ united by their margins into a dentate tube, as is shown in the last whorls, where these tubes are quite free from one another. In *Calycera* the capitulum is seated upon a long scape, the leaves being radical; in *Acicarpha,* and frequently in *Boopis,* where the plant has many branching leafy stems, a capitulum issues from each alternate axil, upon a rather short peduncle. In *Anomocarpus,* in three species, the capitula are nearly sessile in the remote dichotomy of the branchlets; while in another species the axis of the plant is so completely depressed that all the leaves become radical, with its numerous sessile capitula interspersed between them, so that the whole grows into a pulvinate shape with a crowded mass of flowers. In *Nastanthus* all the species assume a somewhat similar form, from an aggregation of its numerous capitula, each supported upon a very thick fleshy peduncle, which bears a single leaf near its summit, a little below the level of the involucre.

In regard to the natural affinities of the *Calyceraceæ,* nearly all systematic botanists are agreed in following the indications first suggested by the illustrious founder of the order, who showed that its closest alliance is with the *Compositæ*; it has consequently been regarded as holding an intermediate position between that family and the *Dipsaceæ,* with which it also accords in its capitate involucrated inflorescence, its monopetalous corolla, its inferior 1-celled ovary with an adnate calyx, its undivided style and simple stigma, and its solitary suspended ovule, —its fruit being likewise a monospermous achænium, crowned by the persistent teeth of the calyx, and the embryo of its seed imbedded in an ample albumen. It differs, however, from the *Dipsaceæ* in the peculiar venation of the corolla, in having its filaments united at the base into a monadelphous ring, and in its combined half-syngenesious anthers.

Mr. B. Clarke * first proposed to separate these families, by some distance, in a natural system founded principally on the normal position of the carpels and the relation of the raphe to the placenta. Under his arrangement, in the monopetalous proterocarpous division of Exogens, he places the *Calyceraceæ* in his *Tetragonal* alliance with *Valerianaceæ* and *Dipsaceæ,* while *Compositæ* appear in his *Myrtal* alliance, the *Onagrarial* alliance being interposed between them. It is needless to say that the grounds of arrangement in this system are most feeble, as the more important considerations of floral and carpological structure, as well as general habit, are completely placed out of view.

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* Ann. Nat. Hist. 2 ser. xi. 454–456

As no other reason is adduced to justify the separation of the two families in question, the validity of their close affinity still remains unimpeached.

Prof. Agardh has likewise proposed the separation of the *Calyceraceæ* from the *Compositæ*, under a still more singular system of arrangement, also founded principally upon the mode of development of the ovules in different plants. He places *Compositæ* at the end of an alliance which embraces *Cycadaceæ*, all the *Coniferæ*, *Ephedraceæ*, *Proteaceæ*, and *Bruniaceæ*, and places *Calyceraceæ* in another alliance of the most heterogeneous kind, comprising *Plantaginaceæ*, *Primulaceæ*, *Dipsaceæ*, and *Gunneraceæ*, the latter family interposing between *Calyceraceæ* and *Compositæ*. The principal reason given for this approximation of *Gunneraceæ* with *Calyceraceæ* is the fact of the single ovule being in both cases suspended from the very apex of the cell, while in *Dipsaceæ* the point of its suspension is somewhat lateral. The view of natural affinities expounded in his work* will not stand the test of investigation; when applied to the case under consideration, we see that *Gunnera*, with its monochlamydeous, often diœcious flowers, which are spicate or racemose and ebracteated, its two simple stamens, its divided style with plumose stigmata, its drupaceous fruit and very minute embryo in copious albumen, offer a combination of characters that place it at a great distance from *Calyceraceæ* in the system. Very similar reasons may be adduced in objection to the alliance of this family with the *Primulaceæ* and *Plantaginaceæ*†.

Bearing in view the very numerous features of analogous structure in the *Calyceraceæ* and *Compositæ*, notwithstanding the difference in position of the ovule and seed, we must conclude that a very close affinity exists between these two families. So intimate, indeed, is this relationship, that should any new system of arrangement be proposed, whether it be linear or circular, which should compel their becoming parted among separate groups on account of the different structure of their carpels, they will naturally take positions that will still touch one another.

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* Theoria Syst. Plant.

† If anything were wanting to show the little practical value of the affinities thus suggested, we have before us the results of two systematists who, starting upon almost identically the same basis, have arrived at conclusions nearly diametrically opposed to each other, and at variance with the established views of relationship universally acknowledged by botanists.

Conspectus generum.

A. Lobi calycini imo amplexi et concavi.

a. Lobi rotundati incrassati. Capitula magna, subscaposa. Receptaculum magnum, carnosum. Involucrum polyphyllum .... 1. NASTANTHUS.

aa. Paleæ inter se accretæ; lobi obovati integri. Capitula minora et subscaposa. Involucrum polyphyllum .... 2. GAMOCARPHA.

aaa. Paleæ omnino liberæ. Involucrum gamophyllum.

* Lobi lanceolati, scariosi, denticulati. Achænia consimilia .... 3. BOOPIS.

** Lobi oblongi, aristati, in nonnullis immutati, parvi, in aliis demum excrescentes et spiniformes. Achænia hinc dissimilia ... 4. ANOMOCARPUS.

B. Lobi calycini subplani et fere subulati, demum elongati et spiniformes.

b. Achænia libera. Receptaculum magnum, latum et depressum .... 5. CALYCERA.

bb. Achænia sæpius agglutinati. Receptaculum parvum, sæpius cylindricum .... 6. ACICARPHA.

1. NASTANTHUS.

In my last journey over the lofty range of the Cordillera of Chile, in 1825, I noticed a very singular plant, of which I then made detailed drawings; these, together with others of much interest, I showed to several botanists during my visit to London in that year: the plant alluded to is the *Calycera Andina* mentioned in my 'Travels,' ii. p. 531. On my return to England in 1838, I proposed it as a new genus, under the name of *Nastanthus*, which genus was adopted by Prof. Lindley in his 'Vegetable Kingdom,' p. 701. Many circumstances have prevented the publication of these details till the present moment.

Nine species are here enumerated, all being of a similar and very distinct habit, somewhat resembling our alpine *Cirsium acaule* in their cæspitose hemispherical shape. They all grow in very elevated situations, in dry rocky soil, much exposed to rough weather, in the lofty Cordillera of the Andes of Chile, on both the eastern and western slopes.

The generic name is derived from ναστὸς, *confertus*, ἄνθος, *flos*, because of the densely aggregated flowers and achænia in each of its capitula, which, again, are so closely crowded as to give to the plant the appearance of a cauliflower-head half imbedded in the ground.

NASTANTHUS, nob.—*Involucrum* gamophyllum, ex foliolis plurimis (10–12) uniserialibus, oblongis, obtusis, sinuato-subtrilobis, crassiusculis, imo in tubum brevem confluentibus constans, et margini receptaculi adnatum. *Receptaculum* magnum,

carnosum, subconvexum, *paleolis* lineari-spathulatis, inter flores exteriores, paucis aut sæpe abortivis. *Flores* dissimiles. *Calycis* adnati *dentes* 5, æquales, rotundati, concavi, carnosi, imo saccati.—*Flores fertiles: corolla* tubo brevi, crassiuscula, infundibuliformis, limbo campanulato, 5-partito, lobis carnosis, oblongis, subcucullatis, erectiusculis. *Stamina* 5, inclusa; *filamenta* imo in tubum brevem monadelphum cum glandulis totidem fauci insertum coalita, superne libera: *antheræ* in tubum 5-dentatum syngenesium connatæ. *Stylus* longe exsertus, filiformis, apice incrassato-cylindraceus. *Stigma* globosum, papilloso-rugosum. *Ovarium* cylindraceum, 5-sulcatum, calycis tubo arcte adnatum, et ejus lobis coronatum. *Achænium* oblongum, profunde 5-lobum, lobis obtusis spongiosis, in umbone apicale breviter conicum, 1-loculare, monospermum. *Semen* ordinis, pendulum.—*Flores steriles: corollæ* tubo gracillime elongato, 2–3-plo longiore, fauce infundibuliformi, limbo campanulato, 5-partito, lobis tenuibus, oblongis, acutis, 3-nerviis, erectiusculis. *Stamina* inclusa; *filamenta* fertiliorum; *antheræ* vix connatæ et polline destitutæ. *Stylus* subexsertus cylindraceo-clavatus, apice vix stigmatosus. *Achænium* semi-inferum, consimile.

Herbæ *Chilenses Andicolæ cæspitosæ*, radice *fusiformi*; folia *radicalia plurima, pluriserialia*, exteriora *petiolata, oblonga, inciso-dentata vel laciniata, carnosa aut submembranacea, glaberrima,* 1–3-*nervia*; scapi *plurimi folio æquilongi, monocephali, carnosi, late compressi, extus convexi, sæpissime ad medium extus folium solitarium sessile gerentes*; capitula *magna in* caput *magnum hemisphæricum creberrime aggregata.* Flores *albi vel pallide virescentes.*

1. *Nastanthus agglomeratus*;—Calycera Andina, *nob. olim, Trav. Chile,* ii. 531;—acaulis, e scapis numerosissimis radicalibus pluriserialibus in massam hemisphæricam confertissime aggregatis cæspitosa, radice fusiformi, scapis monocephalis, carnosis, late compressis, intus planis, extus convexis, et hinc ad medium folium solitarium gerentibus, seriei externæ folio altero radicali donatis; foliis oblongis, obtusis, imo cuneatis, valde carnosis, sicco submembranaceis, sinuato-laciniatis, laciniis paucis, breviter ovatis, subobtusis, imo in costam latam crassissimam decurrentibus, hinc subsessilibus, capitula vix superantibus; capitulis majusculis paulo convexis, carnosis; involucri foliolis circiter 12, uniseriatis, rotundis, erectiusculis, apice obsolete 3-lobis, imo ad receptaculum connatis.—In Andibus Chilensibus, costa orientali, altit. 10,000 ped.

Hanc speciem anno 1825 inveni in ascensu viæ excelsioris inter Mendozam et Aconcaguam ad stationem "Las Cuevas" nuncupatum, locis apertis et asperis gaudentem. Radix fusiformis 5–6 poll. long. Planta integra, humo prona, formam hemisphæricam 6–8 poll. diam. e scapis confertissimis aggregatis æmulans. Scapus 3–4 poll. long. interne planus, extus convexus, summo latitudine fere capituli, et pallide virescens, hinc ad imum gradatim angustior, extus folio unico donatus. Capitulum hemisphæricum, 1–1¼ poll. diam., involucrum e foliolis circiter 12 subtriangularibus, obtusis, summo bisinuatis, imo ad marginem receptaculi uniserialiter connatis, erectiusculis. Folia in scapis exterioribus radicalia, 5 poll. long. in centralibus medium versus scapi affixa, 3½ poll. long.; lamina carnosa penninervis ad marginem petioli crassissimi late decurrens. Receptaculum carnosum convexum, 1 poll. diam., flores numerosissimos creberrime fulciens, quorum plurimos abortivos; denique achæniis numerosis densissime compactis tectum. Ovarium 1½ lin. long. Corolla pallide virescens florum sterilium 2 lin. long., fertilium 6 lin. long., tubo ultra medium gracillime contracto, superne campanulato, limbi laciniis 5 subcucullatis, erectis; stamina inclusa, e contractione corollæ enata; stylus longe exsertus. Achænium oblongum 2½ lin. long., 1 lin. diam., 5-angulatum, inter angulos rotundatos profunde sulcatum; angulis dentibus calycinis rotundatis concavis coronatis, hinc apice umbilicatum, et in centro processu conico porrecto corollam persistentem ferente donatum, nitens, angulis medulla cellulari farctis, 1-loculare, 1-spermum; endocarpio nitente 10-nervio. Semen funiculo brevi pendulum, teres, 1¾ lin. long., ⅛ lin. diam.*

2. *Nastanthus laciniatus*, n. sp.;—acaulis, e scapis plurimis aggregatis cæspitosus, radice fusiformi; foliis ovali- vel oblongo-cuneatis, obtusis, grosse et irregulariter laciniato-dentatis, 5-nerviis, in petiolum latum et elongatum attenuatis, exterioribus majoribus, radicalibus, scapis longioribus, aliisque gradatim brevioribus e basi scaporum enatis; scapis congestis, subcompressis, carnosis, sicco rubiginosis, sæpius nudis, centralibus brevioribus; capitulo majusculo, involucri foliolis 6–8, triangularibus, acutis, serratis, uniserialiter ad receptaculum accretis; paleis foliaceis, exterioribus majoribus et latioribus, centralioribus minoribus, imo attenuatis.—In Andibus Chilensibus.—*v. s. in herb. meo et Hook.*, Los Palomares (Gillies); Cordillera Chile (Cuming 326); Ojos de Agua (Bridges).

Radix fusiformis, 3 poll. long.; caules scaposi, numerosi, patentim radiantes, aggregati, monocephali, 1½–3½ poll. long.

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* A drawing of this plant in its entire state, and of the scape separately, as well as copious analytical details, are given in Plate 43.

(sicci), 3 lin. lati, subpatentes, plantam cæspitosam pronam 8 poll. diam. efformantes; folia exteriora (incluso petiolo) 2½–3½ poll. long.; lamina oblonga, imo cuneata, 1–1¼ poll. long. et 4–11 lin. lat. utrinque dentibus 4 incisa; petiolus crassus, margine membranaceus, 2 lin. lat., caulina 1–2 poll. long., profundius laciniata, 3–5 lin. lat.; capitulum 9–11 lin. diam.; involucri foliola 3-angularia, margine integro vel sinuato-dentato *.

3. *Nastanthus pinnatifidus*, n. sp.;—acaulis, e scapis numerosis radicalibus subbrevibus cæspitosus; foliis longe petiolatis, radicalibus, lamina oblongo-lanceolata, sinuato- et pinnato-partita, laciniis lineari-ellipticis, enervi, crasso-carnosa, costa media lata, subtus prominente; petiolo cum lamina æquilongo vel 2-plo longiore, dilatato, intus concavo, extus convexo; scapis latis, carnosis, petiolo dimidio brevioribus, imo monophyllis; involucri foliolis 3-angularibus circiter 8.—In Andibus Chilensibus.—*v. s. in herb. Hook.* (Cuming, 325); *in herb. Mus. Paris*, Cordillera de Coquimbo (Gay).

Radix crassa; scapi plurimi, aggregati, 1 poll. long., 4 lin. lat., intus plani, extus convexi, simplices, imo foliiferi, in caput hemisphæricum 3 poll. diam., aut cum foliis radiatim expansis 8 poll. diam. compacti; capitulum in flore 6 lin., in fructu 10 lin. diam.; involucri foliola 2–3 lin. long. et lat. Folia exteriora 3–4-serialia, 3½ poll. long., patentissima; lamina 1 poll. long., cum laciniis 6 lin. lat., profunde laciniata, laciniis utrinque 6–7, 2 lin. long., 1 lin. lat.; petiolus 1½–2½ poll. long., superne 1½ lin. lat., imo amplexicaulis 3 lin. lat.: alia e basi scaporum enata gradatim capitis centrum versus breviora †.

4. *Nastanthus Gilliesii*, n. sp.;—acaulis, e scapis radicalibus cœspitosa; foliis radicalibus lanceolato-oblongis, carnosis, enerviis, profunde pinnato-laciniatis, laciniis utrinque 4, lineari-oblongis, obtusis, obliquis, margine revoluto, capitulum paulo superantibus; petiolo lamina 2–3-plo longiore, scapo monophyllo, capitulo majusculo.—In Andibus Chilensibus.—*v. s. in herb. meo et Hook.*, Los Palomares (Gillies).

Scapus (siccus) 2¼ poll. long., 2 lin. lat., intus planus, extus convexus, infra capitulum ampliatus, ubi 3–5 lin. lat. Capitulum 12 lin. diam.: involucri foliola circiter 10, obsolete sinuato-dentata, 1-serialia. Folium ad basin scapi adnatum (incluso petiolo), 2¼ poll. long., lamina 12 lin. long., 6 lin. lat., laciniis obliquis, marginibus revolutis, 5 lin. long., 1½ lin. lat.; petiolus marginibus membranaceis, intus planus, extus convexus, 2 lin. lat.

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* A scape of this species is represented in Plate 44 A.

† This plant is also represented in Plate 44 B.

5. *Nastanthus ventosus*;—Calycera ventosa, *Meyen, Nov. Act.* 19, *Suppl.* i. 251; *Remy, in Gay, Chile,* iii. 256; Calycera scapigera, var. ventosa, *Weddell, Chl. And.* ii. 7;—radice crassa, vesiculoso-inflata; foliis ovatis, obtusissimis; apice paucidentatis, dentibus obtusis, carnosis, 3-nerviis, in petiolum longum attenuatis; scapis pollicaribus, centralibus aphyllis, exterioribus 1–2–3-phyllis; involucro 5–7-partito.—Chile ad Rio Maypù.

Planta mihi incognita, evidenter e descriptione, hujus generis inter *N. pinnatifidum* et *N. scapigerum* intermedia.

6. *Nastanthus scapigerus*;—Boopis scapigera, *Remy, in Gay, Chile,* iii. 250; *Weddell, Chl. And.* ii. 7;—radice fusiformi; caule brevi, scapos plurimos monocephalos confertim aggregatos gerente; scapis superioribus foliis minoribus donatis, inferioribus radicalibus, liberis, et cum foliis majoribus e basi ortis; foliis rotundo-ovalibus, e medio cuneato-spathulatis, et hinc in petiolum 2-plo longiorem utrinque decurrentibus, crenatis vel grosse dentatis, dentibus obtusis, margine revoluto, lamina infra medium integra, pallide glaucis; involucri foliola 7–9, foliolis parvis, triangularibus, acutis, subintegris; floribus confertissimis involucro longe superantibus; paleis exterioribus dilatatis, foliaceis, aliis gracile attenuatis.—In Andibus Chilensibus. —*v. s. in herb. meo,* Cordillera de Maule (Germain).

Radix fusiformis, 1½ poll. long.; caulis 1 poll. long., scapis circiter 24, crebriter confertis, munitus; scapi superiores 6–15 lin. longi, inferiores 20 lin. long., compressi, 1½ lin. lati, 5 lin. diam.; folia radicalia longiora (incluso petiolo) 2 poll. long., lamina ovata, imo cuneata, 9 lin. long., 7 lin. lat.; petiolus compressus, 1½ lin. lat., imo amplexicaulis; capitulum florescens 5 lin. diam., in fructu 9 lin. diam.; involucri foliola 1½ lin. long.; 2 lin. lat.; receptaculum in fructu auctum ad 5 lin. diam., convexum; achænium ut in *N. agglomerato**.

7. *Nastanthus compactus*;—Boopis compacta, *Philippi, Linn.* 28. p. 709;—"acaulis, glaberrima, cæspitosa; foliis rosulatis, lineari-spathulatis, integerrimis, coriaceis; capitulis in apice radicis sessilibus, confluentibus; involucris inde irregularibus; paleis paucissimis, setaceis; dentibus calycinis (dum floret) obsoletis; tubo corollæ brevi cylindrico, membrana exteriore tubi hyalina ab interiore viridi remota."—In Andibus Chilensibus, Prov. Maule, Depart. Liñares (Germain).

"Folia 26 lin. longa, 3 lin. lata, obtusa, sensim versus basin attenuata. Capitula in massam diametri fere 2 poll. aggregata, exteriora separata, interiora vero confluentia. Ovarium 1¼ lin. long., fructus non suppetunt."

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* A drawing of this plant is given in Plate 44 D.

Species mihi invisa, sed ex char. supra transcriptis manifeste videtur, ob habitudinem suam peculiarem, ad hoc genus pertinere. Sic explicatur:—caule perbrevi, scapos plurimos brevissimos fere obsoletos monocephalos fulciente; scapis exterioribus liberis, longioribus, e basi enatis; foliis radicalibus lineari-spathulatis, integris, coriaceis.

8. *Nastanthus spathulatus*;—Boopis spathulata, *Philippi, Linn.* 28. p. 708;—" cæspitosus, caule brevi, crasso, scapis plurimis fastigiatis monocephalis munito; scapis interioribus brevissimis, et fere confluentibus; foliis coriaceis, spathulatis, dentatis, caulinis confertissimis; involucri foliolis 5, ovato-triangularibus, acutis; floribus viridibus, involucrum superantibus; paleis subnullis."—In Andibus Chilensibus, Prov. Maule, Depart. Linares.

" Caulis 4 poll. alt., 5 lin. crassus, radicem versus attenuatus; folia 2½–3 poll. long., 8 lin. lat., grosse inciso-dentata; capitulum circa 9 lin. diam.; corolla 3½ lin. long., tubo filiformi, superne ampliore."

Species mihi ignota, clare ad *N. scapigerum* accedens.

9. *Nastanthus Gayanus*;—Boopis Gayana, *Philippi, Linn.* 28. p. 709;—dense cæspitosa, scapis subaphyllis, centralibus confluentibus; foliis radicalibus, coriaceis, linearibus, pinnatifidis, ultra medium nudis, laciniis oblongis, obtusis; involucri foliolis imo connatis, lato-linearibus, obtusis; corolla brevi, subcylindrica, membrana exteriore tubi hyalina et ab interiore viridi remota; paleis setaceis.—In Andibus Chilensibus, Santa Barbara, Prov. Arauco (Gay).

Folia radicalia 2½ poll. long., lamina 1 poll. long., cum lobis 4¼ lin. lat., lobis utrinque 4–5. Scapi exteriores liberi, 1 poll. long., 2½ lin. crassi, alii sæpe folio sub capitulum donati; capitulum 9 lin. diam.; involucri foliola brevissima, nonnulla longiora; corolla alba, vix 2 lin. long.; dentes calycini distincti.

2. Gamocarpha.

The typical species was collected in Chile by Pöppig, who described and figured it under the name of *Boopis alpina*. DeCandolle afterwards founded upon it his genus *Gamocarpha*, its name expressing the fact of the accretion of its paleæ, first indicated by Lessing, from whose imperfect account DeCandolle established his brief and defective generic character. Lessing's

obscure description is as follows: "Bracteolæ (paleæ) 1-nerviæ, acutæ, apice foliaceæ connatæ in alveolas profundas ovaria tota laciniis 5 ellipticis, acutis, ipsis brevioribus coronata includentes." (Linn. vi. 259.) Pöppig states that the inner whorls of involucral leaflets are sometimes small or rudimentary, "nonnunquam minimæ vel rudimentariæ, sensim in bracteolas (paleas) per receptaculum planiusculum sparsas transeuntes." (Nov. Gen. i. 21.) DeCandolle makes no mention of the existence of any paleæ, nor of the fact of their accretion which gave rise to his name of *Gamocarpha*, while the presence of paleæ is distinctly specified in all the other genera of the family; in their place, however, he states the existence of a fringed sheath round the base of each ovary, which I have not been able to discover: he says, "fimbrillæ recept. acutæ in alveolas concretæ." From this it is manifest that he never examined the plant, that he did not understand Lessing's meaning (rendered still more obscure by Pöppig's description), and that he consequently omitted all details of this unusual structure.

I have had an opportunity of examining a plant in the Herbarium of the Paris Museum, collected by Gay in the same neighbourhood as that where Pöppig found his specimens; and this, compared with the drawing and description of the latter botanist, shows beyond any doubt that it is identical with the typical species which Lessing and Pöppig have severally described. The involucre is here composed of six external folioles, which are very thick and fleshy, and united at their base into a short tube, upon the margin of the fleshy receptacle; within this are four concentric series of paleæ, which are nearly of the length and size of the folioles, and are equally fleshy and green at their summits, though more membranaceous below: they are confluent by their margins for half their length, and the intervals between them are again divided by a number of membranaceous septa emanating from the fleshy midribs of some of the paleæ, and united to the margins of others in the adjoining series, forming in this manner a number of hollow tubular spaces, in three or four irregularly concentric series, spread over the surface of the receptacle: each of the spaces thus constituted contains three or four florets; but the spaces here formed are wrongly designated alveolæ of the receptacle as this term is generally used by botanists; hence the term employed by Lessing was evidently misunderstood by DeCandolle. I have drawn up the following as a more correct expression of its generic features:—

GAMOCARPHA, Dec. — *Involucrum* 5–6-phyllum; *foliola* ovata, crasso-carnosa, integra, margine subcartilaginea, subacuta, imo in tubum brevissimum margini receptaculi coalitum

accreta. *Receptaculum* convexiusculum, carnosum; *paleæ* magnæ, foliaceæ, inter flores onustæ, nonnullæ liberæ, spathulatæ, pleræque ovatæ, carnosulæ, involucro æquilongæ, imo latæ, marginibus usque ad medium mutuo concretis in verticilla 3–4 subconcentrica coalitæ, istis e septis plurimis interjectis in nidulos multos tubæformes 3–4-seriales constitutis: hoc modo transmutatæ, per totum receptaculum sparsæ, et imo eo arcte accretæ; *flores* in singulo nidulo 3–4 imo insiti, plerique fertiles, 5-meri, rarius abortu 4-meri. *Calycis* tubus, ovario adnatus, margine discreto 5-dentato, dentibus æqualibus, ellipticis, acutis, erectis, carnosulis. *Corolla* regularis, infundibuliformis, tubo gracili longo, limbo 5-lobo; lobis oblongis, obtusiusculis, apice crassioribus et macula fusca notatis, 3-nerviis. *Stamina* 5, inclusa; *filamenta* brevissima, imo in annulum monadelphum constrictioni tubi insertum coalita, superne libera, et introrsum arcuata: *antheræ* inferne syngenesæ, et breviter sagittatæ, apice liberæ, connectivo crasso dorsali filamento continuo affixæ. *Ovarium* obovatum, ultra medium ad calycem accretum, apice liberum, conicum, 1-loculare, 1-ovulatum. *Stylus* filiformis, longe exsertus, apice incrassato-cylindraceus. *Stigma* minimum, globosum, papilloso-rugosum. Achænium ignotum.

Herbæ *Chilenses, Andicolæ, cæspitosæ, acaules,* rhizomate *elongato, repente stolonifero, colles plurimos intersistentes foliiferos emittente*; folia *subradicalia, congesta, lineari-spathulata, integerrima, carnosa*; *scapi pauci, monocephali, folio longiores, sæpius nudi, rarius foliis* 1–2 *supra medium donati, teretes, carnosi*; capitulum *hemisphæricum, carnosum.*

1. *Gamocarpha Pöppigii,* DC. Prodr. v. 2; Remy in Gay, Chile, iii. 247; Weddell, Chl. And. ii. 8;—Boopis alpina, *Pöpp. Nov. Gen.* i. 21, tab. 33; *Lessing, Linn.* vi. 258;—acaulis, foliis subradicalibus, confertis, obovato-ellipticis, apice mucronatis, integris, carnosis, margine cartilagineis, glaberrimis, enerviis, in petiolum angustum canaliculatum fere æquilongum attenuatis, scapis 2–3, folio 3-plo longioribus, sæpius aphyllis.—In Andibus Chilensibus: Cordillera de Concepcion ad Antuco, altit. 6500 ped.; Cordillera de Concepcion (Gay), *in herb. Mus. Paris.*; *v. s.*

Radix horizontaliter humifusus, pedalis et ultra, colla plura interrupta subacaulia, squamis imbricatis tecta, 5 lin. long. 3 lin. diam. emittens; folia e collo numerosa, pluriserialia, subradicalia, imbricatim conferta, (incluso petiolo 2–4 lin.) 6–10 lin. longa, 2–3 lin. lata, vernatione conduplicata: scapi 2–3, erecti, teretes, 2 poll. longi, sæpius nudi, interdum versus apicem folia 2 brevia subopposita gerentes, monocephali;

capitulum subglobosum, cum floribus expansis circiter 10 lin. diam.; involucrum cum foliolis expansis 5 lin. diam.; foliola 5–6, receptaculo carnoso imo accreta, superne libera, sinuato-3-angulata, acuta, integerrima, carnosula, margine cartilaginea, viridia, 1-nervia, 2 lin. longa et fere 2 lin. lata; paleæ numerosæ, foliolis consimiles, 2 lin. longæ, 1½ lin. latæ, per totum receptaculum imo inter se accretæ, et hoc modo nidulos plurimos efformantes, apice quasi laciniatos favos apiarios æmulantes, singulatim 3–4-floros; flores imo inserti, longe exserti, consimiles, hermaphroditi, 3 lin. longi; ovarium ad calycem adnatum, 1 lin. longum; corolla viridis, 2 lin. longa, imo tenuissima; stamina ore campanulato 5-dentato inclusa; stylus longe exsertus *.

2. *Gamocarpha Gilliesii*, n. sp.;—radicibus fusiformibus, distantibus, descendentibus, stolone horizontaliter sarmentoso connexis; foliis radicalibus, plurimis, confertis, rotundato-ovatis, imo in petiolum angustum 2-plo longiorem cuneatis, crasso-carnosis, rachi prominente, enerviis; scapis 1 vel 2, teretibus, subgracilibus, summo crassioribus, folium vix excedentibus; capitulo præcedentis dimidio minore; involucri foliolis 5–8, æqualibus, spathulato-oblongis, subacutis, crassis, imo breviter inter se et cum receptaculo accretis, demum reflexis; paleis foliolis consimilibus, inter se imo coalitis, floribus exsertis.—In Andibus Chilensibus:—*v. s. in herb. Hook.*, Cerro del Polcura (Gillies); Los Palomares, Punta de las Vacas, costa orientali; Ojos de Agua, costa occidentali (Bridges).

Species a præcedente distincta; sarmentum horizontaliter humifusum, colla plura interrupta, 1¼ poll. remota, subacaulia, squamis imbricatis tecta, 3 lin. long., radicibus fusiformibus donata emittens; folia plura, radicalia, (incluso petiolo) 1¼–1½ poll. long., 3 lin. lat.; scapi 1–2, teretes, apice incrassati, monocephali, sæpius nudi, interdum folio unico infra medium donati, foliis radicalibus minore, 10 lin. long., 2 lin. lat.; capitulum subhemisphæricum, 6–8 lin. diam.; involucri foliola 3 lin. long., 1½ lin. lat.†

3. *Gamocarpha pumila*, n. sp.;—nana, cæspitosa, caulibus brevissimis et fere obsoletis, paucis, scapiformibus, crassiusculis, foliis dimidio brevioribus, monocephalis; foliis plerisque radicalibus, spathulato-lanceolatis, subobtusis, 5-nerviis, integerrimis, in petiolum complanatum subæquilongum attenuatis, paucis, caulinis fere epetiolatis, cuneato-oblongis, paulo sub capitulis enatis, iis multo longioribus; involucri foliolis

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* The details of this structure are shown in Plate 45 A.

† A drawing of this plant will be seen in Plate 45 B.

inæqualibus, 8–10, subexpansis, lineari-oblongis, obtusis; paleis foliaceis, imo inter se accretis, exterioribus foliola involucri subæquantibus.—In Andibus Chilensibus:—*v. s. in herb. Hook.*, Cordillera de Maule, sedibus orientalibus (Germain).

Planta sesquipollicaris, radice fusiformi; in uno specimine scapus unicus 7 lin. longus, nudus, in altero scapi 2 æquilongi, folio solitario paulo sub capitulo muniti; folia plurima, radicalia, (petiolo incluso) 1½–2¼ poll. long., limbo obtuso, spathulato-oblongo, 3 lin. lato, petiolo angustissimo, æquilongo; folium caulinum 15 lin. long., 3 lin. lat.; capitulum floriferum 6 lin., fructiferum 15 lin. diam.; involucri foliola 1½ lin. long., ½ lin. lat., subpatentia; paleæ exteriores foliolis consimilibus; achænium immaturum ejus *Nastanthi* forma*.

4. *Gamocarpha ligulata*, n. sp.;—humilis, fere acaulis; foliis plurimis, radicalibus, spathulato-linearibus, integris, in petiolum subtenuem complanatum angustatis, glaberrimis, enerviis; scapis paucis, aphyllis, folio 2-plo longioribus, rarius foliolis 3 superne munitis, teretibus, lævibus, monocephalis; involucri foliolis sub 10, subinæqualibus, spathulato-oblongis, obtusis, integris, carnosulis, patentibus; paleis foliaceis, majusculis, foliola involucri æquantibus, imo breviter inter se accretis, apice liberis et spathulatis, erectiusculis; floribus exsertis.—In Andibus Chilensibus:—*v. s. in herb. Hook.*, Prov. Arauco (Lechler, 289).

Planta cæspitosa, 3-uncialis; radix fusiformis; folia 1–1½ poll. long., 1½ lin. lat., in petiolum ¼ lin. lat. angustata; scapi 2-3, erectiusculi, teretes, ½ lin. crassi, 2¼–2½ poll. alti; capitulum floriferum cum foliolis expansis 1 poll. diam.; receptaculum 5 lin. diam.; foliola involucri 3–4 lin. long., 1–1½ lin. lat.†

3. Boopis.

This genus was established in 1803 by Jussieu, upon a plant collected by Commerson in the neighbourhood of Buenos Ayres, which he named *Boopis anthemoides*: with this he associated the *Scabiosa sympaganthera* of the 'Flora Peruviana,' which was afterwards separated and placed in *Calycera*. Richard, in his admirable memoir on the *Calyceraceæ*, published in 1820, gave ample details of the structure of the genus, then reduced to its typical species. To this original type are to be added three new species recently described by Dr. Philippi, and three others which I now contribute; so that the genus will thus comprise

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* This species is represented in Plate 45 C.

† This plant is shown in Plate 45 D.

seven species. *Boopis* in many points approaches *Acicarpha,* but it differs from that genus in having a gamophyllous involucre in the form of a depressed cup with an incised border, quite free from its small globular receptacle, which is not of larger diameter than its peduncular support, and which remains bristled with the persistent radiating paleæ after the achænia have fallen off: it is also distinguished from that genus by its achænia being quite free from each other, and not accreted into a cylindrical or spherical mass; and by its calycine lobes, which preserve their original form, and do not become enlarged in the form of long excrescent subulate spines. It differs from *Calycera* in the union of the free leaflets of the involucre into a gamophyllous cup, and in its isomorphous achænia, not heteromorphous with the calycine segments often becoming enlarged into extremely long spines.

The genus *Acarpha* has been proposed by Dr. Grisebach * for a Magellanic plant of this family collected by Lechler. It obtained this name on account of the supposed absence of paleæ in the receptacle; but I have examined authentic specimens of Lechler's collection in the Museum of Paris, and find very distinct paleæ present in all the capitula, though not accompanying all the florets. Even if this were a distinct genus, the name would require to be changed; but it appears to me a true *Boopis,* as its involucrum shows; and in the peculiar form of its achænia it quite accords with *B. multicaulis* and *B. gracilis.*

Boopis, Juss. Char. reformat.—*Involucrum* gamophyllum, cyathiforme, depressum, submembranaceum, plurinerve, fere ad medium 5–10-dentatum, dentibus integris, vel denticulatis, lanceolatis, vel 3-angularibus, venoso-reticulatis, rigidulis. *Receptaculum* parvum, convexum, *paleolis* linearibus, scariosis, apice dilatatis, achæniis æquilongis, persistentibus echinatum. *Flores* omnes fertiles et consimiles. *Calycis tubus* adnatus, ovario brevior; *lobi* 5, dentiformes, acuti, submembranacei, integri vel inciso-denticulati, imo marginibus involutis et cum costis prominentibus ovarii accretis. *Corollæ tubus* gracilis, ovario longior, superne campanulatus; *limbus* 5-fidus, laciniis acutis, reflexis. *Stamina* 5, subexserta; *filamenta* brevissima, imo in tubulum e contractione tubi corollæ ortum connata, superne discreta; *antheræ* ad basin connatæ, apice liberæ. *Ovarium* acute 5-costatum, tubo calycino adnatum, apice liberum, hinc conicum, 5-sulcatum. *Stylus* capillaceus, exsertus, apice cylindraceo-clavatus. *Stigma* globulosum, rugosum.

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* Diagn. Pl. Philippi et Lechler, p. 37; Walp. Ann. v. p. 142.

Achænium 5-costatum, dentibus calycinis mucronatis rigidis patentibus supra medium circumdatum. *Semen* ordinis. Suffrutices *humiles Bonarienses, Chilenses, et Patagonici, ramosi, rarius cæspitosi*; caules *flexuosi, ramosi*; folia *rigida, lineari-elongata, laciniato-dentata, aut pectinato-laciniata, laciniis angustis linearibus*; pedunculi *solitarii, vel pauci, ex axillis superioribus, monocephali.*

1. *Boopis anthemoides*, Juss. Ann. Mus. ii. 350; Rich. Mem. Mus. vi. 41. tab. 11;—caule striatulo, ramosissimo; foliis caulinis simplicibus, linearibus, ramorum pinnato-pectinatis, laciniis 3–5–7, angustissime linearibus, apice aciculatis, coriaceo-rigidis; pedunculis monocephalis, capitulis parvis, subsphæricis, involucro 5-fido, lobis triangularibus, mucronatis, denticulatis, patentibus.—Prov. Cordova Argentinarum ad Punta de Agua et Cañada de Lucas.—*v. v.*

Frutex parvus, fere decumbens, e basi ramosissimus, 4–6-pollicaris, rarius altior, locis uliginosis et salitrosis gaudens: rami lignosi, flexuosi, internodiis brevibus, 2–4 lin. distantibus; folia alterna, in ramis primariis simplicia, linearia, 3–5 (rarius 7) lin. long., $\frac{1}{4}$ lin. lat., coriacea, rigida; margine cartilagineo reflexo, apice pungenti-mucronato; in ramis secundariis pectinato-pinnatifida, sæpius 3-juga cum impari, 5–9 lin. long., laciniis anguste linearibus, 3 lin. long., rachique $\frac{1}{4}$ lin. lat., rigida et mucronata; pedunculi breves, monocephali, in ramulis terminales et axillares, 3–9 lin. long.; capitula 3–5 lin. diam.; involucrum parvum, imo gamophyllum et pateriforme, margine profunde 5-laciniatum, laciniis patentibus, 1 lin. long.; receptaculum parvum, simplex; paleæ tot quot flores, spathulatæ, acutæ, subrigidæ, $1\frac{1}{2}$–2 lin. long.; flores numerosissimi, consimiles; calyx profunde 5-sulcatus, ovario adnatus, margine 5-dentatus.

2. *Boopis rigidula*, n. sp.;—caulibus simplicibus, erectis, angulato-striatis, paulo flexuosis; foliis pinnato-sectis, laciniis rachique anguste linearibus, 4–5-jugis cum impari, divaricatis, apice mucronatis, opacis, rigide coriaceis, margine revoluto, utrinque pallidis, costa mediana in angulos caulinos decurrente; capitulo solitario terminali, longe pedunculato; involucro gamophyllo, late campanulato, submembranaceo, fere ad medium 10-fido, laciniis linearibus, acutis, erectis, integris, 3-nervatis, apice aciculatis; paleis lineari-lanceolatis, mucronatis; floribus æquilongis; dentibus calycinis membranaceis, ovatis, 1-nerviis, apice obtuse 3-dentatis.—Chile, *v. s. in herb.*

meo et Hooker.; Patagonia (Capt. King), et in Andibus Mendozinis (Gillies).

Species a præcedente distincta; differt caule strictiore, foliis longioribus, rigidioribus, segmentis latioribus et crassioribus, substramineis; pedunculo longissimo solitario; involucro 10-dentato. Internodia superiora 1 poll. distantia, inferiora approximata; folia pallide glauca, rigida, $1\frac{1}{4}$–$1\frac{3}{4}$ poll. long., rachi lineari parallele nervoso $\frac{1}{2}$ lin. lat., laciniis divaricatis 6–8 lin. long., $\frac{1}{2}$ lin. lat.; pedunculus $3\frac{1}{4}$ poll. long., capitulum subglobosum; involucrum hemisphæricum, campanulatum, 6 lin. diam., vix ad medium 10-dentatum, dentibus integris, linearibus; receptaculum minimum, fundo involucri insitum *.

3. *Boopis gracilis*, Philippi, Linn. xxviii. 707;—annua, glaberrima, glauca, polycephala, ramosa, ramis cauleque elongatis, gracilibus; foliis superioribus lineari-spathulatis, pectinatim laciniatis, dentibus utrinque 3–5 remotiusculis, supremis integris, omnibus enerviis; pedunculis gracilibus, monocephalis; involucro gamophyllo, campaniformi, ad medium 5-dentato, dentibus late 3-angularibus, flores æquantibus, paleis paucissimis, setaceis, achænio 5-costato, angulis paulo prominulis. —In Andibus Chilensibus:—*v. s.*, Cordillera de Maule, Depart. Linares (Germain).

Planta habitu *Anomocarpi leucanthemi*, circa 9-pollicaris; radix fusiformis, ramosus, 3 poll. long.; caulis e basi ramosus, $1\frac{1}{4}$ lin. diam.; rami alterni, iterumque divisi, angulato-striati; folia inferiora e basi linearia, 12–15 lin. long., ultra medium integra, summum versus dentibus brevibus patentibus remotis· laciniata; folia superiora 6–7 lin. long., $\frac{1}{3}$ lin. lat.; pedunculi ex axillis superioribus solitarii, monocephali, folio 2–3-plo longiores; capitulum $4\frac{1}{2}$ lin. diam.; corolla $1\frac{1}{2}$ lin. long., tubo gracillimo, viridi, limbo albo; achænia albida, ovata, acuta, 5-angulata, in sinubus transversim rugosa, $1\frac{1}{2}$ lin. long., diametro paulo minore; dentes calycini angulis continui, obtusi; paleæ persistentes; receptaculum parvum, depresso-conicum, foveatum†.

4. *Boopis multicaulis*, Ph., Linn. xxviii. 706;—glaberrima, caulibus elongatis e basi plurimis, erectis, ultra medium subnudis; foliis radicalibus elongatis, longissime petiolatis, summo profundissime pinnato-partitis, laciniis remotiusculis, spathulato-oblongis, obtusis, integris, aut sæpe utrinque 1-dentatis, carnosulis, enerviis, pallide viridibus, subtus flaves-

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* A representation of this species is given in Plate 46 A.

† A drawing of this plant will be seen in Plate 46 B.

centibus, petiolo limbo 2–3-plove longiore, complanato, imo dilatato; caulinis paucis, alternis, multo brevioribus, brevius petiolatis, pinnato-partitis; pedunculis axillaribus et terminalibus, 1–4, elongatis, nudis, aut rarius folio brevi munitis, summo paulo incrassatis et monocephalis; involucro gamophyllo, ultra medium 5-partito, laciniis 5, inæqualibus, spathulato-linearibus, integris aut 3-dentatis, paleis lanceolatis, aut setaceis.—In Andibus Chilensibus:—*v. s. in herb. meo et Hook.*, Cordillera de Maule, Depart. Linares (Germain).

Caules pedales; folia radicalia 3½–4½ poll. long. (incluso petiolo), laciniis utrinque 6–7, plerisque integris, 6–7 lin. long., 1½–2½ lin. lat., caulina vix pollicem longa; pedunculi teretes, striati, straminei, 2½–3 poll. longi; capitulum globosum; involucrum imo campanulatum, cum laciniis crassis mucronatis patentibus 6–9 lin. diam., dentibus (ubi adsunt) calloso-mucronatis; flores tubo viridi elongato, limbo albido, 3 lin. longi, 5-meri; achænium pentagonum, 5-sulcatum, angulis dentibus calycinis parvis obtusis concavis coronatis *.

5. *Boopis squarrosa*, n. sp.;—subcæspitosa, glabra, caulibus vel pedunculis subscapiformibus, plurimis; foliis pluribus radicalibus, aliisque caulinis brevioribus, lineari-lanceolatis, inciso-serratis, laciniis remotis, angulatis, acutis, mucronatis, sæpe subrecurvis, in petiolum longissimum complanatum angustatis; pedunculis monocephalis, sub apice foliiferis, ad apicem incrassatis; involucro cyathiformi ultra medium 5-fido, laciniis linearibus, acutis, denticulatis; paleis floribus brevioribus, lineari-spathulatis.—Ad Fretum Magellanicum:—*v. s. in herb. Hook.* (Le Guillou).

Planta cum foliis radicalibus divaricatis 5 poll. diam.; folia radicalia numerosa, circiter 3 poll. long., dentibus inclusis 3 lin. lat., iis exclusis 1 lin. lat., 1-nervia; caulis scapiformis, 3 poll. long., paulo supra basin ramosus, ramo æquilongo monocephalo supra medium folio 4–6 lin. long. munitus; capitulum 9 lin. diam.; involucri segmenta 4 lin. long., 1 lin. lat.; paleæ centraliores ovario 2-plo longiores, exteriores 2-plo majores; dentes calycini acuti, hyalini, carinati, carinis cum angulis ovarii continuis †.

6. *Boopis* (?) *australis*, Dcne. Voy. Pôle Sud, Bot. ii. 87, tab. 18 B; Acarpha Australis, *Griseb. Diagn. Pl. Lechler.* 38; *Walp. Ann.* v. 142;—cæspitosa, caule brevi, e scapis centralibus 3–4

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* This species is represented in Plate 46 C.

† This plant is shown in Plate 47 A.

ad medium inter se accretis; scapis dehinc alternatim liberis, imo et infra capitulum foliiferis, scapis alteris brevissimis, in externa serie plurimis, cum foliis radicalibus enatis, summo sub capitulo folio unico longo lineari munitis, omnibus radiantibus, et monocephalis; foliis radicalibus plurimis, rosulatis, divaricatis, capitula longe superantibus, caulinisque brevioribus, anguste linearibus, summo paulo latioribus, obtusis, subcarnosis, integris, enerviis; capitulis parvis; involucro 7–8-fido, segmentis linearibus subinæqualibus flores superantibus.—Ad Fretum Magellanicum :—*v. s. in herb. Mus. Paris. et in herb. Hook.*; in Penins. Brunswick ad "Packet Harbour" (Lechler, 1143).

Planta cum foliis expansis 5 poll. diam.; folia radicalia 2–2¾ poll. long., 1 lin. lat., superne paulo latiora, et hinc subspathulata; caules 9–12 lin. long., 1½ lin. lati, compressi; scapi 3–6 lin. long., ¾ lin. lat., compressi; capitula juniore ætate, 3 lin. diam.; involucri segmenta 7–8, inæqualia, 2½–4 lin. long., 1 lin. lat.; flores 1–1½ lin. long. Paleas paucas distincte vidi, lineari-spathulatas, carnosas, virides, florum longitudine. Ovaria creberrima, profunde 5-angulata, in juniore ætate angulis late alæformibus, diaphanis, arcte congestis, et imo inter se vix adhærentibus. Clar. Grisebach, qui fructus vidit, dixit, "achenia pentagona inferne transversim rugosa," et inde libera; idcirco species ad *Boopidem* retuli *.

7. *Boopis graminea*, Phil. Linn. xxviii. 707;—perennis, glaberrima; foliis radicalibus confertis, elongato-linearibus, obtusiusculis, integerrimis, erectis, basin versus angustatis, carnosis, uninerviis; scapo erecto, longissimo, tereti, striato, monocephalo, infra medium foliifero, superne nudo; involucro circiter 8-phyllo, capitulum æquante; paleis setaceis; tubo corollæ brevi.—In Andibus Chilensibus :—*v. s. in herb. Hook.*, Prov. Maule, Depart. Linares.

Planta *Gamocarphæ* habitum aliquanto simulat, sed, e receptaculo et paleis, ad hoc genus nullo modo convenit; in aspectu omnibus præcedentibus valde dissimilis, nihilominus structura floralis cum *Boopide* satis congruat. Radix alba, 3½ lin. crassa; scapus pedalis, basi 2 lin. crassus; folia radicalia plurima, rosulata, 2½–3½ poll. long., 1 lin. lat.; folia scapi breviora; capitulum 8 lin. diam.; corolla 2 lin. long., omnino alba, tubo attenuato, paleæ liberæ, lineari-setaceæ; ovaria libera, profunde 5-angulata, et, ut in ultima specie, valde hyalina, dentibusque 5 acutis coronatis †.

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* A representation of this species is given in Plate 47 B.

† This species is represented in Plate 47 C.

4. ANOMOCARPUS.

I have already alluded to this genus, which differs from all others of this order in many esssential characters. The inflorescence generally consists of a single head of a few florets standing upon a very short peduncle, in each axil of the dichotomously branching stems; the involucre is thin, membranaceous, cup-shaped, divided half-way down into a 5-toothed border, its receptacle being reduced to a small point scarcely larger than the summit of the peduncle, and in some instances quite void of paleæ. The achænia are remarkably dissimilar in form; in some the calycine lobes retain their original shape, or become almost obsolete, while in others they become greatly elongated into subulate, rigid, concave, straight, patent, and almost spinose expansions: hence the generic name, derived from *ἄνομος, inæqualis*; *καρπὸς, fructus.* This habit prevails in the three first-mentioned species; but in the fourth the stems disappear, the plant becoming completely depressed and cæspitose; the cauline leaves thus come to be entirely radical and radiating, each bearing upon its petiole an almost sessile capitulum, the whole plant forming a somewhat hemispherical head, as in the genus *Nastanthus.* This species is the *Calycera pulvinata* of Remy, from whose description it formerly appeared to me to constitute a new genus, which I suggested under the name of *Discophytum* (Lindl. Veg. Kingd. 703), agreeing with *Nastanthus* in its peculiar habit, and approaching *Anomocarpus* in other respects. Subsequently I obtained a sight of the plant, and its examination convinced me that it agrees perfectly with the latter genus in its floral and carpological structure, and is dissimilar in no respect except in its habit, which is entirely due to the complete depression of its axis, by which it is reduced to cæspitose proportions. Each capitulum represents a depressed branch, its leaves, thus approximated, assume a campanular involucral form, being accreted at their base into a broad shallow cup supported upon a short stipe, with a border of foliaceous segments; and it contains about seven distinct capitella, which are analogous to the short scapes, each bearing a monocephalous head, seen in each axil of the stem in the typical species, but in this instance all are brought close together by the depression of the stem; each capitulum is supported upon a short stipe, and consists of an involucel of five to seven linear leaflets containing a solitary spined achænium in the centre, surrounded by seven or eight other achænia which are quite unarmed, and all are supported by a small epaleaceous receptacle. Thus considered, the plant exhibits all the peculiar and essential characters of *Anomocarpus.*

I have united with this genus the *Leucocera* of Turczaninow, founded upon the *Boopis leucanthema* of Pöppig, which agrees with *Anomocarpus* in all essential respects, except that the receptacle is more convex, almost conical, and charged with persistent paleæ, after all the achænia have fallen off, as in *Boopis*. These characters are hardly sufficient to claim a distinct generic rank for *Leucocera*—a name that would have been ill applied, as the spines of the achænia are of a yellowish brown colour. The great difference in the form of the achænia was scarcely recognized by Turczaninow—a feature better characterized by the name *Anomocarpus*, which I had long previously employed for the more legitimate species.

ANOMOCARPUS, nov. gen.—*Involucrum* gamophyllum, campanulatum, plus minusve profunde partitum, membranaceum, plurinerve, nervis 15–21, parallelis, laciniis 5–7, triangularibus aut lineari-oblongis, acutis, erectis, interdum demum auctum et explanatum. *Receptaculum* minimum, areolatum, nudum, rarius parce paleaceum. *Flores* sæpius pauci, inclusi, omnes fœcundi. *Calyx* ovario adnatus, 5-angulatus, in floribus radii limbi lobis abortivis, in unico centralibus (sæpe unico) lobis 5, æqualibus, liberis, ovatis, acutis, denticulatis et mucronatis, erectis, demum patentibus et excrescentibus. *Corollæ* omnes consimiles, tubo infundibuliformi imo coarctato, cum ovario articulato, limbo breviter campanulato 5-partito, lobis acutiusculis, crassiusculis. *Stamina* subexserta; *filamenta* imo in tubum brevissimum syngenesa, medio tubi corollæ inserta, apice longiuscule libera, et conniventia; *antheræ* oblongæ imo in tubum accretæ, in floribus radii sæpe polline destitutæ. *Ovarium* oblongum, 5-angulatum, imo ad calycem adnatum, supra medium liberum, hinc conicum, 5-sulcatum, 1-loculare, 1-ovulatum; *ovulum* funiculo brevi ex apice pendulum. *Stylus* filiformis, exsertus, apice paulo incrassatus. *Stigma* subglobosum, papillosum. *Achænia radii* obovata, inermia, profunde 5-costata, costis transversim rugosis, apice nodis cupuliformibus stylum versus conniventibus (e lobis calycinis tabidis) munitis; *centralia* iis radii conformia, sed supra medium lobis calycinis longissime excretis, acutissime mucronatis, horizontaliter patentibus, profunde concavis, imo tubiformibus, margineque tenui scarioso-denticulatis coronata. *Semen* ordinis.

Herbæ *Chilenses, sæpius pusillæ et erectæ, dichotome ramosæ;* folia *in dichotomiis solitaria, alterna, spathulato-lanceolata, longe petiolata;* capitula *parva, interdum demum aucta, in dichotomiis solitaria, breviter pedunculata.*

1. *Anomocarpus axillaris*, n. sp.;—herbacea, glaberrima, caulibus

nonnullis, e basi dichotome ramosis; foliis in axillis ramorum, alternis, elliptico-lanceolatis, spathulatis, integris vel paucidentatis, 3-nerviis, petiolo angusto æquilongis; capitulis in dichotomiis solitariis, brevissime pedunculatis; involucro membranaceo, campanulato aut semigloboso, 5-partito, 15-nervio, laciniis 3-angularibus, erectis; receptaculo parvo, 6-floro; floribus exsertis; achæniis 5, exterioribus inermibus, unico centrali spinis longis latis acutissimis canaliculatis denticulatis coronato.—Chile, *v. s. in herb. Hook.* (Valparaiso, Cuming, 664).

Planta 3-pollicaris; internodi inferiores 11 lin., superiores 7 lin. distantes; folia inferiora (incluso petiolo limbo æquali) $1\frac{1}{2}$ poll. long., limbo 3 lin. lat., integra; superiora remote dentata (utrinque dentibus 2), incluso petiolo $1\frac{1}{4}$ poll. long., limbo 2 lin. lat.; pedunculus brevissimus, $\frac{1}{4}$–1 lin. long.; involucrum semiglobosum, campanulatum, 2 lin. long., 3 lin. diam., ad medium 5-dentatum; flores exserti; ovarium $\frac{1}{2}$–$\frac{3}{4}$ lin. long.; corolla $1\frac{1}{4}$ lin. long.; achænium $1\frac{1}{2}$ lin. long., spinis 5, patentibus, $1\frac{1}{2}$ lin. long., rigidis, profunde canaliculatis*.

2. *Anomocarpus subsessiliflorus*;—Calycera sessiliflorus, *Ph. Linn.* xxviii. 706;—annua, caulibus paucis, ramosis; foliis radicalibus oblongis, in petiolum attenuatis, remote et grosse dentatis, caulinis breviter petiolatis; capitulo primo fere radicali, reliquis in dichotomiis caulis subsessilibus; involucro semigloboso, capitulum æquante, achæniis nonnullis spinis 5 complanatis fructui fere æquilongis coronatis, 5-costatis, lævibus, aliis dentibus brevibus terminatis, 5-angularibus, angulis rugosis.—Chile, *v. s. in herb. Hook.*; prope Quillota (Germain); Cerro Bravo, prope Santiago (Philippi).

Species præcedenti valde proxima; differt foliis latioribus, majoribus et grosse dentatis, capitulo involucro æquilongo, achæniis spinosis plurimis, spinis brevioribus, et reliquis dentibus brevibus coronatis. Planta circiter 3-pollicaris; folia (incluso petiolo) 2 poll. long., 5 lin. lat., capitula 3 lin. diam.†

3. *Anomocarpus eryngioides*;—Calycera eryngioides, *Remy, in Gay, Fl. Chil.* iii. 254; *Weddell, Chl. And.* ii. 7, tab. 43 A;—herbacea, debilis, caulibus plurimis simplicibus, laxatim dichotome ramosis, ramis flexuosis, remotis, glaberrimis, angulato-striatis; foliis radicalibus semi-pinnatifidis, longissime

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* A drawing of this plant, with details of its structure, is given in Plate 48 A.

† This species is shown in Plate 48 B.

attenuatis, superioribus caulinis, alternis, spathulato-oblongis, integris aut pauci- grosso- et mucronato-dentatis, submembranaceis, nervosis, utrinque glaberrimis; petiolo lineari limbo tertia parte breviore; pedunculis in dichotomiis solitariis, folio dimidio brevioribus, imo glabris, summo puberulis, demum in fructu 3-plo longioribus, monocephalis; involucro late campanulato, 5-dentato, glaberrimo, dentibus 3-angularibus, demum in fructu valde aucto, tunc rotatim expanso, submembranaceo et parallelim nervoso; receptaculo minimo, multifloro; paleis paucis, inæqualibus, lineari-subulatis, imo tenuissime attenuatis, viridibus, nonnullis floribus longioribus, aliis multo brevioribus; corollæ tubo filiformi, elongato, superne infundibuliformi; achæniis centralibus inermibus, exterioribus longissime spinosis, spinis 5, divaricatis, inæqualibus.—In Andibus Chilensibus, Prov. Santiago, *v. s. in herb. Mus. Paris.*

Planta pedalis et ultra, ramis 1 lin. diam., subflexuosis, nitidis, striatis, medulla cellulosa repletis, sicco fragilibus; internodi 3 poll. remoti; folia caulina (incluso petiolo angusto æquilongo) 1½ poll. long., 3–5 lin. lat., alterna; capitula (dum florent) 6 lin. diam.; involucrum gamophyllum, tunc late campanulatum, ad medium 5-dentatum, dentibus acutis subexpansis, 6–8 lin. diam., demum valde augescens et in fructu 1¾–2¼ poll. diam., viride, membranaceum, reticulato-nervosum, complanato-expansum et folium planum stellatum simulans; receptaculum convexum, 2 lin. diam.; flores numerosissimi, fere omnes consimiles; paleæ paucissimæ, virides, lineari-spathulatæ, imo angustissimæ, apice acutæ, mucronatæ, 3–7 lin. long., ¼–¾ lin. lat.; calyx adnatus, 5-angulatus, breviter 5-dentatus; corollæ 5 lin. long. tubus imo gracillime coarctatus, pro dimidio vel tertia parte superne infundibulatus; limbi laciniæ 5, lineares, erectæ; stamina longitudine fere laciniarum 1 lin. long.; filamenta imo in annulum brevem liberum ori tubi affixum connata; antheræ lineares, imo breviter syngenesæ, superne liberæ; stylus apice incrassatus, exsertus. Achænia spinigera pauca, cum plurimis inermibus intermixta, turbinata, profunde 5-angulata, 2 lin. long., spinis 5 (quarum 2 sæpe brevioribus), 3 poll. long., patentissimis, subulatis, superne sulcatis, acutissime pungentibus, stramineis, imo incrassatis et denticulatis; inermia plurima, pleraque centralia, 1½ lin. long., 1 lin. diam., profunde sulcata, angulis 5, lævibus, convexis et dentibus calycinis minimis concavis superatis, apice conico, corolla persistente 2–3-plo longiore sæpius terminata; in externa serie pauca, inermia, corolla persistente reliquis breviore (cujus stamina emasculata) apicata*.

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* A drawing of this species, with analytical details, is given in Plate 48 c.

4. *Anomocarpus pulvinatus*;—Calycera pulvinata, *Remy, Ann. Sc. Nat.* 3^{e} sér. vi. 352; *Walp. Ann.* ii. 382; *Weddell, Chl. And.* ii. 6, tab. 43 B;—acaulis et cæspitosus, pusillus, glaberrimus; foliis radicalibus, paucis, radiatis, rhomboideo-oblongis, squarroso-laciniatis, laciniis irregularibus, obtusis, calloso-mucronatis, imo in petiolum elongatum deplanatum spathulatis, crasso-carnosis, e basi 5-nerviis; capitulis numero foliorum, imo petiolorum fere sessilibus, et in orbem pulvinatum dense glomeratis, singulatim breviter involucratis; involucris gamophyllis, 5–7-partitis, singulis capitella 4–8 iterumque involucellata claudentibus; involucellis gamophyllis, profunde 5–7-partitis; receptaculo minimo, epaleaceo; floribus 6–10, longe exsertis; involucris involucellisque fructiferis, demum valde auctis et tunc arcte consociatis; achæniis exterioribus inermibus, unico centrali in quoque involucello semper spinescente.—Bolivia, *v. s. in herb. Mus. Paris.*; grand plateau des Andes, Prov. Carangas (Pentland, spec. fructif.); circa Laguna, Potosi (Weddell, spec. florif.).

Planta pusilla, inclusis foliis radiantibus 2–3 poll. diam.; pulvinus capitulorum, ætate florali, 10–12 lin. diam., e capitulis 16–20 crebriter aggregatis; folia circiter 16–20, omnia radicalia (incluso petiolo sublongiore) 1–1¾ poll. long., et inclusis laciniis 6 lin. lat.; petiolus imo submembranaceus, 1 lin. lat.; capitula 3–3½ lin. diam., subglobosa; pulvinus capitulorum, ætate fructifera, 2½–3 poll. diam.; involucra subsessilia, pateriformia, 7–10 lin. diam., 3 lin. alta, imo plana et gamophylla, foliolis 7–9, hinc liberis, erectiusculis, subimbricatis, obovato-oblongis, margine denticulatis, membranaceis, reticulato-venosis; involucella in singulo involucro sæpius 8 (forsan e paleis inter se in verticillum imo accretis), breviter pedicellata; pedicellus complanatus, 1 lin. long. et lat.; tubus gamophyllus, 2 lin. diam., 1 lin. alt., foliolis uniserialibus, circiter 7, lineari-oblongis, acutis, membranaceis, erectis, parallele nervosis, subinæquilongis, 3–5 lin. long., 1–1½ lin. lat.; receptaculum planum, minimum, epaleolatum, areolatum, pauciflorum; achænium centrale unicum, spinigerum, 1¼ lin. long., profunde angulatum, spinis 5, subulatis, subæqualibus, subdivaricatis, imo incrassatis, cum angulis lævibus continuis, 3–4 lin. long.; achænia exteriora circiter 8, inermia, 1 lin. long. et lat., 5-angulata, in sulcis transversim rugosa; flores in externa serie abortivi et immutati *.

5. *Anomocarpus leucanthemus*;—Boopis leucanthema, *Pöp. Nov. Gen.* i. 21, tab. 34; *Lessing, Linn.* vi. 259; *DC. Prod.* v. 2; *Remy in Gay, Chile,* iii. 250; *Weddell, Chl. And.* ii. 8;—Leu-

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* Full details of this structure are shown in Plate 49 A.

cocera annua, *Turcz. Flor. B. Zeit.* xxxi. 712; *Walp. Ann.* ii. 807;—Acicarpha lanata, *Lag. Pers. Ench.* ii. 438; *DC. l.c.* 3;—herba pusilla, radice fusiformi, caule sæpius e basi ramoso, ramisque gracilibus, flexuosis, dense cano-lanuginosis; foliis pinnatifidis, laciniis patentibus rachique anguste linearibus, glaberrimis, crassis, calloso-mucronatis, radicalibus longe petiolatis, caulinis tertia parte brevioribus; pedunculis oppositifoliis, lanuginosis; involucro campanulato, profunde 5–8-fido, laciniis inæqualibus, linearibus, mucronatis, glabris, flores superantibus.—In Andibus Chilensibus, in scaturiginosis, *v. s. in herb. Mus. Paris. et Hook.*; in excelsis Cordillera de Antuco, Prov. Arauco (Pöppig); Cordillera de Colchagua (Bridges, 1186–1187); circa Talca (Germain).

Species habitu generis *Acicarphæ* valde similis, sed differt achæniis omnibus liberis et dissimilibus, involucro libero, profunde laciniato, imo gamophyllo; a *Boopide* etiam differt achæniis dissimilibus, aliisque longe spinosis. Planta 3–5 poll. alta; caulis dense lanatus, paulo supra basin ramos plurimos emittens, ramis erectiusculis, præsertim summo dense lanatis; folia radicalia 1 poll. long. incluso petiolo limbo æquilongo, 3–4 lin. lat.; pedunculi oppositifolii, lanati, in flore 3 lin., in fructu 6–9 lin. long., monocephali; capitula in flore hemisphærica, 3 lin. diam., in fructu globosa, 4–5 lin. diam.; involucrum glabrum, immutatum, demum reflexum; receptaculum semiglobosum, foveatum, ¾ lin. diam., paleis persistentibus spathulato-setaceis sparsis onustum. Corolla tubo gracili viridi, limbo expanso albo 5-partito æquilongo; segmenta linearia, acuta. Achænia omnia usque ad basin libera, creberrima, fusca, inermia et spinigera intermixta, obconica, profunde 5-angulata, in sulcis transversim rugosa, 1½ lin. long., lobis calycinis stellatim radiatis, naviculiformibus, acutis; alia majora, 2 lin. long., brunnea, straminea, angulis acute carinatis, et in spinis e lobis calycinis valde auctis terminatis, spinis superne profunde sulcatis, subulato-compressis, subtus carinatis, 1½ lin. long.*

6. *Anomocarpus tenuis*, n. sp.;—caulibus simplicibus, gracillime elongatis, flexuosis, primum decumbentibus, mox erectis, stramineis, sub lente parce puberulis, demum glabris, foliis pinnato-sectis, laciniis linearibus, membranaceis, utrinque 2, in petiolum angustissimum attenuatis, glaberrimis; pedunculis remotis, oppositifoliis, valde elongatis, monocephalis; capitulis semiglobosis, involucro fere ad basin 5-laciniato, laciniis anguste linearibus, membranaceis, glabris; paleis

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* A drawing of this species will be seen in Plate 49 c.

persistentibus, longis, spathulatis, involucro æquilongis.—Chile, *v. s. in herb. Mus. Paris.* (Gay).

Caulis gracilis, 10 poll. alt., ¼–½ lin. diam; folia 9 lin. long., segmentis rachique ½ lin. lat., supremis simplicibus 3–4 lin. long., subsetaceis; pedunculus in flore 6 lin., in fructu 18 lin. long.; capitulum 2–3 lin. diam.; flores quam in *A. leucanthemo* pauciores et minores; corolla 5 lin. long.; achænia alba, libera, pleraque inermia, ½ lin. long., alia pauca, brevissime spinigera *.

7. *Anomocarpus tenuifolius*; Calycera tenuifolia, *Phil. MSS.*;—subcæspitosa, caulibus pluribus brevioribus, subdecumbentibus, lanato-pilosis; foliis radicalibus plurimis, radiantibus, elongatis, longe petiolatis, profunde pinnato-partitis, laciniis subdivaricatis, linearibus, glaberrimis, superne enerviis, subtus costa mediana prominula signatis; caulinis brevioribus, alternis; pedunculis axillaribus, oppositifoliis, incurvis, pilosis, monocephalis; capitulis parvis.—In Andibus Chilensibus, *v. s. in herb. Hook.*; Cordillera de Chillan (Germain).

Radix fusiformis, 2 poll. long.; caules 2–2¼ poll. long.; folia radicalia 1–1½ poll. long., petiolo 6–9 lin. long., rachique ½–1 lin. lat., laciniis inæqualibus, sæpius 4–5-jugis, 1–2 lin. long., ½–1 lin. lat.; folia caulina 6–12 lin. long.; pedunculi 3 lin. long.; capitulum 2–3 lin. diam.; flores 2 lin. long.; ovarium 5-angulatum, 5-carinatum, obconicum, dentibus 5, erectis, carnosulis, acutis, dorso carinatis; corollæ tubus gracilis, viridis, limbo albo, 5-partito.

5. Calycera.

The type of this genus, *Calycera Cavanillesii,* was the earliest known species of this family, having been described and figured by Cavanilles in 1797, under the name of *Calicera herbacea.* The genus is distinguished by the extreme growth of its calycine segments, which become expanded into very long spines. In this respect it approaches *Anomocarpus* and *Acicarpa.* From the latter it is distinguishable only by its free achænia and by the much greater length which their spinescent lobes attain; from the former it is distinguished by the much greater length of the peduncles that support the capitula, and by the different form of its seeds.

The genus *Gymnocladus* has been proposed by Dr. Philippi (Linnæa, xxviii. p. 705) upon the slender character of the partial abortion of the leaves of the involucre and a globose receptacle, in a plant which otherwise possesses the habit and all the floral

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* This plant is represented in Plate 49 B.

characters of *Calycera*. Upon these features we may remark that Richard (Mém. Mus. vi. 34), in his description of the typical species, *Calycera Cavanillesii,* shows that the leaflets of the involucre are wanting, and figures the receptacle as globose, both in that species and in *C. balsamitæfolia* (*l. c.* pl. 10 A and 10 B). There does not exist, therefore, a single feature in *Gymnocladus* distinct from *Calycera*. In DeCandolle's Monograph of the family, he enumerates only two species of this genus: four other species are here contributed, with the following amended generic character:—

CALYCERA, Cav., Rich.—Char. reform.: *Involucrum* polyphyllum; *foliola* 5–7, uniserialia, imo ad torum accreta, subinæqualia, lineari-lanceolata, integra vel serrata, patentia, sæpe abortiva. *Receptaculum* convexum, subglobosum, carnosum, amplum, *paleis* spathulato-linearibus acutis inter flores onustum. *Flores* dissimiles et promiscui. *Calyx* tubulosus, tubo ad ovarium omnino adnato, margine parvo libero 5-dentato, dentibus æqualibus, acutis, concavis, mucronatis, sæpe demum inæqualiter excrescentibus. *Corolla* ovario multoties longior, tubo gracili fauce campanulato, limbi 5-fidi laciniis oblongis, apice crassiusculis, acutis, paulo expansis. *Stamina* exserta, *filamenta* imo in tubum monadelphum contractioni corollæ insertum coalita, superne disjuncta; *antheræ* mediante connectivo crasso dorsali apicifixæ, imo syngenesæ, apice liberæ. *Ovarium* oblongum, 5-sulcatum, tubo calycino breviori adnatum, hinc apice conico liberum, uniloculare, uniovulatum. *Ovulum* pendulum. *Stylus* filiformis, longe exsertus, apice incrassato-clavatus. *Stigma* parvum, globosum, papillosum. *Achænia* plurima, congesta, omnino libera, oblongo-turbinata, 5-sulcata, lobis calycinis nonnullis (2–3–4) longissime elongatis, subulato-spinescentibus, divaricatis, aliis lobis squamaceis aut abortivis coronata. *Semen* ordinis.

Herbæ *Andicolæ et Chilenses*; radix *fusiformis*: folia radicalia *congesta, lineari-lanceolata, incisa vel dentata*; caulina *pauca, breviora*. Inflorescentia *in ramulis terminalis,* pedunculo *sæpius elongato, simplici, monocephalo*; capitulum *subglobosum.*

1. *Calycera Cavanillesii,* Rich. Mém. Mus. vi. 34, tab. 10; Remy in Gay, Chile, iii. 253; Weddell, Chl. And. ii. 7;—C. herbacea, *Cav. Icon.* iv. 35, tab. 358;—glaberrima, caulibus plurimis, subscapiformibus, remote 2-foliatis, substrictis; foliis radicalibus subsessilibus, longo-lanceolatis, acutis, remote semipinnatifidis, imo in petiolum angustum spathulatis, caulinis consimilibus, multo minoribus; capitulo terminali; achænio

spinis 2–3-plo longioribus patentibus armato.—Chile, Concepcion.

Planta mihi invisa; folia radicalia ex descriptionibus 4–5 poll. long., et cum laciniis 6 lin. lat., petiolo lamina 3-plo longiore, 1 lin. lat.; caulis scapiformis, 8 poll. long., 1 lin. diam.

2. *Calycera balsamitæfolia*, Rich. Mém. Mus. vi. 38, tab. 10;—Boopis balsamitæfolia, *Juss. Ann. Mus.* ii. 350;—Scabiosa sympaganthera, *R. & P. Flor. Per.* i. 49, tab. 76 *a*;—Caule erecto, superne ramoso, ramulis suberectis, leviter pilosis, pedunculo nudo foliolatove monocephalo terminatis; foliis radicalibus congestis, caulinis sparsis, spathulato-lanceolatis, inciso-dentatis, laciniis remotis fere pinnatifidis, glabellis, margine ciliato-puberulis, imo in petiolum linearem complanatum cuneatis; capitulis majusculis; involucro multipartito, laciniis oblongis, acutis, puberibus.—Chile, Prov. Concepcion, *v. s. in herb. Mus. Paris.* (Cl., Gay).

Caules plures, fere 2-pedales, erecti, obsolete striati, virgati; folia radicalia 2½ poll., caulina 1¾–2¼ poll. long., cum laciniis 4–6 lin. lat.; capitula in flore 7–8 lin. diam., demum in fructu 14 lin. diam.; involucrum multipartitum, laciniis lanceolatis, integris, patentibus, inæqualibus; flores involucro excedentes; calycis dentes 5, parvi, subrotundi; corollæ tubus imo tenuissimus, viridis, superne infundibuliformis, 5-fidus, albus; paleæ inter flores plurimæ, spathulatæ, foliaceæ, involucro æquilongæ, margine ciliatæ.

3. *Calycera squarrosa*, n. sp.;—glaberrima; foliis radicalibus plurimis congestis, oblongis, irregulariter pinnatifido-incisis, summo segmentisque obtusiusculis, iterum sinuato-dentatis dentibus spinescenti-mucronatis, crassis, margine cartilagineo, in petiolum longissimum angustum alatum decurrentibus; pedunculo scapiformi, monocephalo, nudo, folio breviore; capitulo majusculo; involucro ad basin 5-partito, laciniis linearibus, patentibus, aceroso-denticulatis; paleis spathulatis, acerosis, crassis, viridibus, flores excedentibus.

Species duabus præviis affinis, sed planta multo humilior: folia (petiolo incluso) 3 poll. long., lamina pollicaris, 7 lin. lat.; segmenta 2–3 inferiora remota et squarrosa; petiolus alatus, 1½–2 poll. long., 1 lin. lat.; pedunculus nudus, 1 poll. long., apice crassior; capitulum 1 poll. diam.*

4. *Calycera sinuata*, n. sp.;—glaberrima; foliis radicalibus plurimis, congestis, ovato-oblongis, irregulariter sinuato-dentatis dentibus brevibus, apice callosis, crassis, sub-3-nerviis, in

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* This species is represented in Plate 50 A.

petiolum longum cuneatis; caulinis paucis, alternis, conformibus, et multo brevioribus; capitulo terminali; involucri foliolis 5, spathulato-oblongis, subintegris, crassis, patentibus. —In Andibus Chilensibus, ora orientali (Puente del Inca, altit. 8000 ped.), *v. v.*

Planta anno 1825 mihi inventa, habitu præcedentis, 3-pollicaris; radix fusiformis, $1\frac{3}{4}$ poll. long., folia radicalia 2 poll. long., 4 lin. lat., lamina in petiolum complanatum alatum linearem subæquilongum decurrens; caulina similia, 9 lin. long., 2 lin. lat.; capitulum in fructu globosum, 9 lin. diam., spinis inclusis $1\frac{1}{2}$ poll. diam.; foliola involucri 4 lin. long., $1\frac{1}{4}$ lin. lat.; achænii spinæ rigidæ, patentes, subulatæ, superne subsulcatæ [*].

5. *Calycera viridiflora*;—Gymnocladus viridiflorus, *Phil. Linn.* xxviii. p. 706;—glaberrima, caulibus paucis, e basi enatis, sæpius folio unico munitis, scapiformibus, teretibus, validiusculis, monocephalis, foliis radicalibus plusquam 2-plo longioribus, interdum subramosis, ramo etiam florigero, imo apiceque florifero; foliis radicalibus plurimis, crebre congestis, elongatis, limbo ovato aut oblongo, inæqualiter laciniato-dentato dentibus interdum erosis et mucronatis, glauco-viridi, crassiusculo, in petiolum loriformem elongatum alatum decurrente; capitulo globoso, involucro 5-fido, laciniis 2–3 linearibus, cuspidatis, reliquis brevioribus; receptaculo globoso, paleis plurimis, flore brevioribus, spathulatis, cuspidatis, viridibus, nonnullis filiformibus onusto.—In Andibus Chilensibus, Cordillera de Maule, Depart. Linares (Germain), sub. nom. *C. nudicaulis*, Phil. MSS.

Species sine dubio hujus generis, præcedenti et sequenti valde affinis; specimina communicata sub titulo *Calycera nudicaulis*, sed planta descripta sub nom. *Gymnocladus viridiflorus*: planta non semper nudicaulis, et igitur nomen vix idoneum. Folia radicalia (petiolo incluso) 2–3 poll. long., lamina ovata aut oblonga, 8–10 lin. long., 4–7 lin. lat.; pedunculus scapiformis, nudus, $4\frac{1}{4}$ poll. long.; capitulum globosum, 12–16 lin. diam.; calyx 1 lin. long.; corolla $3\frac{1}{2}$–4 lin. long., cum staminibus styloque intense viridis; achænii spinæ valde inæquales, longiores, 7 lin. et ultra long.[†]

6. *Calycera spinulosa*, Gill. MSS., n. sp.;—foliis radicalibus congestis, lanceolato-oblongis, sinuato-dentatis dentibus aceroso-spinosis, patentibus vel recurvis, infra medium cuneatis et integris, 5-nerviis, carnosulis, glaberrimis, imo in petiolum

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[*] A drawing of this plant is given in Plate 50 B.

[†] A figure of this species is given in Plate 50 C.

latum subamplexicaulem decurrentibus, hinc quasi sessilibus, cauli subscaposo æquilongis; caulinis paucis, multo minoribus; caule sæpius pedunculo unico longiusculo monocephalo terminato, interdum ramo altero foliifero et florifero donato; involucri foliolis 5–7, lanceolatis, acutis, pectinato-dentatis, dentibus spinulosis; paleis basi latis, apice subulatis.—Prov. Mendosæ ad Tortoral et Las Arboletas, in arenosis, *v. s. in herb. Hook.* (Gillies, sub nom. *C. spinulosa*).

Planta humilis, 3–3½ poll. alt.; radix fusiformis; folia pleraque radicalia, 2¾ poll. long., 4–7 lin. lat., imo cuneato-spathulata; caulina 9–12 lin. long., 3–4 lin. lat.; caulis sæpe scapiformis, fere nudus, 3 poll. long.; capitulum 9 lin. diam.; involucri foliola 5–6 lin. long., 2 lin. lat.; achænium 1½ lin. long., 5-angulatum, spinis inæqualibus, divaricatis, longioribus 5–8 lin. long., subulatis *.

Var. *β. serratifolia*;—foliis elliptico-lanceolatis, submembranaceis, sinuato-serratis, dentibus calloso-mucronatis, imo integro cuneatis, 5–7-nerviis, glaberrimis; caule scapiformi, solitario (an semper?), monocephalo, nudo, foliis radicalibus breviore; paleis integris, acutis.—In Andibus Mendozinis, *v. s. in herb. Hook.*; circa Casa Pintada (Gillies).

Folia majora, textura tenuiora, 4 poll. long., 1 poll. lat., imo integra, latiora; scapus 2 poll. alt.; capitulum circa 1 poll. diam.

6. Acicarpa.

This genus, first established by A. de Jussieu, was named by him *Acicarpha* †, because of the spinose lobes of its achænia, which he erroneously attributed to the growth of the paleæ, and their accretion with the ovarium. Mr. Robert Brown first detected this error, and showed that the spinose excrescences were owing to the growth of the calycine lobes, and not of the paleæ; and hence he objected to the name of *Acicarpha* as being inadmissible, suggesting in its stead the far more appropriate epithet of *Acicarpa* ‡. DeCandolle and other botanists have disregarded this suggestion, and have retained Jussieu's name; but it appears to me that we are bound to adopt that of *Acicarpa*, so long ago recommended by Mr. Brown. The little difference existing between this genus and *Calycera* has been already pointed out, consisting principally in the much greater length of the excrescent calycine lobes, and in the accretion of the achænia with each other and with the receptacle; but this last-mentioned

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* This plant is figured in Plate 50 d.

† Ann. Mus. ii. p. 347.

‡ Linn. Trans. xii. p. 132; Mém. Mus. vi. pl. 11 & 12. fig. b.

feature is not a constant character. Richard represents the ovaria as being immersed within a fleshy receptacle; this, however, is an erroneous view of the case: the receptacle is, in fact, merely a cylindrical axile column, upon which the ovaria are imposed, thus resembling an abbreviated spikelet, round which the flowers are densely crowded; from this receptacle a secretion exudes, which flows between the ovaria, and finally agglutinates them and all the lower portion of the spikelet into one compact mass. Sometimes, however, this agglutination is only partial, especially towards the middle and summit of the inflorescence; and it then occurs that many of the achænia, perfectly mature, are as free as in *Calycera*, which fact I have frequently observed in *Acicarpa tribuloides*: even in the typical species the ovaria of the upper florets always remain free, as Richard has described them*; but in that species these free achænia seldom perfect their seeds. In *Acicarpa* the calyx, which is adnate to the ovarium, is deeply 5-sulcate, the prominent midrib of its five free teeth being continuous with its salient angles; at first it is of delicately thin texture, and extremely transparent, consisting apparently of two integuments with a fluid or vacant mesodermal space between them; for the one can be made to move loosely over the other by pressure. The subsequent increment of the calyx seems to arise from the deposition of solid matter (probably derived from the receptacle) within the mesodermal space: the midribs of the calycine leaves seem to acquire the greatest amount of increment, becoming lengthened into thick pungent spines; the calycine lobes are at the same time expanded into the globose nodules that form the bases of the spines; while the external surface of the calycine tube becomes horny and solid; the mesodermal space, being much enlarged, is filled with compact cellular tissue, which dries into a light spongy or pithy substance. While this deposition is taking place within the integuments of the achænia, a similar exudation from the receptacle flows between the numerous achænia, and agglutinates them, together with the receptacle, into one solid echinate globose head, as before described. This appears to be the nature of the change in the development of the fruit in *Acicarpa*. There is an evident difference in the growth that takes place in the calyx of *Acicarpa* and in that of *Calycera*: in the former the excrescent spines are shorter, nodose at their base, subulate, with a small groove along their inner face; in the development of the spines in *Calycera* the calycine lobes disappear or become entirely expanded into divaricated spines of much greater length and thickness, subulate and semiterete in form, being flattened

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* Mém. Mus. vi. 46, tab. 11 B. fig. 5. achænia coalita, fig. 6. alia libera.

on their upper surface. The generic features of *Acicarpa*, as here given from my own observations, will be found to differ in many essential respects from the characters assigned to it by Richard and DeCandolle.

ACICARPA, R. Br.;—Acicarpha, *Juss.*;—Cryptocarpha, *Cass.*—Char. emend.: *Involucrum* polyphyllum; *foliola* 5, lineari-oblonga, inæqualia, persistentia, uniserialia, toro parvulo adnata; *receptaculum* lineari-cylindricum, toro suffultum, *paleis* obovatis ovario longioribus inter flores onustum. *Flores* consimiles, superiores nihilominus substeriles. *Calycis tubus* ovario 5-angulato arcte adnatus, *limbo* libero 4–5-dentato, dentibus parvis, ovatis, obtusiusculis, hyalinis, textura laxa, tubi angulis continuis, demum excrescentibus. *Corollæ tubus* gracilis, ovario 2-plo et limbo sesquiduplo longior, *limbo* infundibuliformi profunde 4–5-partito, laciniis oblongis, obtusiusculis, crassis, sub-3-nerviis. *Stamina* inclusa; *filamenta* imo in tubum monadelphum carnosum fauci insertum coalita, apice brevissime disjuncta; *antheræ* oblongæ, basi emarginatæ, imo usque ad medium syngenesæ, dehinc liberæ, connectivo crasso dorsali imo nodoso filamento continuo affixæ. *Ovarium* tubo calycis adnatum, 1-loculare, 1-ovulatum, apice conico nudum. *Achænia* plurima, congesta, brevia, profunde 5-sulcata, pleraque (præsertim inferiora) inter se et cum receptaculo in globum echinatum concreta, lobis calycinis excrescentibus et spinescentibus, divaricatis; pauca superiora, sæpe libera, vel interdum (sed non semper) sterilia. *Semen* ordinis.
Herbæ *perennes, Brasilienses, Bonarienses et Chilenses, subprocumbentes*; radix *subfusiformis*; caules *plures, ramosissimi*; folia *alterna*, radicalia *petiolata*, caulina *sessilia, oblonga vel linearia, integra vel inciso-dentata*; pedunculi *oppositifolii, monocephali, axillares et terminales.*

1. *Acicarpa spathulata*, R. Br., Linn. Trans. xii. 129;—Acicarpha spathulata, *Rich. Mém. Mus.* vi. 78, tab. 12; *DC. Prodr.* v. 3;—Cryptocarpha spathulata, *Cass. Dict.* xii. 85;—Sommea calcitrapa, *Bory*;—Echinolema arenarium, *Jacq. fil.*;—Acanthosperma littorale, *Velloz, Flor. Flum. Icon.* viii. tab. 152;—Buphthalmum Bonariense, *Pers. Ench.* ii. 474;—glabra, caulibus decumbentibus, ramosis; foliis cuneato-oblongis, apice rotundatis et mucronatis, imo in petiolum longum decurrentibus, integris vel rarius paucidentatis, 3-nerviis, utrinque cano-glaucis; pedunculo monocephalo in ramulis axillaribus terminali, folio longiore; involucri foliolis inæqualibus, spathulato-oblongis, mucronatis, integris, patentibus, flores longe excedentibus.—Rio de Janeiro, in arenosis maritimis.

Planta bene cognita et auctoribus ampliter descripta; receptaculum in juniore ætate filiformi-cylindraceum; ovaria numerosissima, illinc cum paleis totidem brevioribus interspersa, crebriter circumposita, mox cohærent omnia in massam solidam, centralia (aut superiora) libera et sterilia, ut in aliis speciebus.

2. *Acicarpa crassifolia,* n. sp.;—glaberrima, caule subdecumbente; foliis inferioribus spathulato-lanceolatis in petiolum brevem latum cuneatis, superioribus subsessilibus, cuneato-ellipticis, subobtusis, carnosis, margine subrevoluto remote et obsolete sinuato-denticulatis, 3-nerviis, nervis subtus prominulis; pedunculo solitario, terminali, monocephalo; capitulo majusculo; involucri foliolis 5–7, obovato-oblongis, acutis, mucronatis, membranaceis, margine crassiusculo, integro.—Maldonado, in dumetis arenosis, *v. s. in herb. Hook.* (Tweedie).

Species præcedenti valde analoga, sed folia viridiora, breviora et latiora, margine denticulata; planta 5-pollicaris; folia alterna, 1–2 poll. long., 6–8 lin. lat., petiolo lato, subamplexicauli, brevissimo; pedunculus terminalis 1 poll. long., apice incrassatus; capitulum fere 1 poll. diam., semiglobosum; involucrum fere ad basin 5–7-partitum, laciniis patentibus; paleæ setaceæ vel spathulatæ, ovaria concreta excedentes; corollæ tubus gracilis, 2½ lin. long.; limbus infundibuliformis, ultra medium 5-partitus, tubo fere æquilongus, segmenta oblonga, acuta*.

3. *Acicarpa bupleuroides,* Less. Linn. vi. 527; DC. *loc. cit.* 3; —erecta, glabra, dichotome ramosa; foliis oblongo-obovatis, basi in petiolum alatum subamplexicaulem angustatis, obtusis, integerrimis vel apice subdentatis, reticulato-venosis; capitulis terminalibus; involucro inæqualiter 5-foliolato, foliolis lineari-elongatis, calyce corollaque 4-lobis.—Brasilia meridionalis, in uliginosis (Sello).

Species mihi invisa, ex descriptione autem cl. Lessingii ab alteris manifeste distincta; herba perennis, 1½–4 ped. alt., habitu *Bupleuri rotundifolii*; capitulum parvum, eo *Artemisiæ Absinthii* vix majus; folia alterna, remota, 6 poll. long., 1½ poll. lat.

4. *Acicarpa procumbens,* Less. Linn. vi. 527; DC. *loc. cit.* 3;—glaberrima, caulibus plurimis, procumbentibus, valde ramosis; foliis lineari-spathulatis, in petiolum planum attenuatis, integerrimis, mucronulatis, glaucis, membranaceis, 3-nerviis, nervis superne immersis, subtus prominulis; pedunculis monocephalis, primum terminalibus, demum lateralibus, folio brevioribus; involucri segmentis 6, floribus brevioribus, integerrimis, oblongo-ellipticis, patentibus, inæqualibus.—Brasilia meridionalis, *v. s. in herb. Hook.* (Sello).

Planta habitu ad *A. spathulatam* accedens; folia remo-

* A drawing of this plant is given in Plate 51 A.

tiora, fusciora, angustiora, membranacea, et capitula multo minora; caules 6–12 poll. long., debiles; folia 1-1¾ poll. long., 2–4 lin. lat.; petiolus angustus; pedunculi teretes, oppositifolii, fere 1 poll. long.; capitula semiglobosa, 5 lin. diam.; involucri foliola 2 lin. long., 1 lin. lat., acuta*.

5. *Acicarpa tribuloides*, R. Br. *l. c.*;—Acicarpha tribuloides, *Juss. Ann. Mus.* ii. 348, tab. 58. fig. 1; *Rich. Mém. Mus.* vi. 45, tab. 11; *DC. Prodr.* v. 3;—Cryptocarpha tribuloides, *Cass. Dict.* xii. 85;—subdecumbens, dichotome subramosa; foliis cuneato-oblongis, obtusis, sinuato-dentatis aut lacerato-incisis, laciniis mucronatis, glaberrimis, submembranaceis, valde reticulatis, inferioribus spathulatis, superioribus sessilibus, et basi latiore semi-amplexicaulibus.—In Provinciis Argentinis, *v. v.* ad Zanjon, Prov. Cordovæ.

Species ad præcedentem et sequentem proxime accedens; a priore differt foliis dentatis aut inciso-laciniatis, a posteriore foliis vix pinnatifidis et basi non auriculatis. Folia 3–3½ poll. long., 4–9 lin. lat.; pedicelli 6–9 lin. long.; involucri foliola linearia, integra, obtusa, 4–5 lin. long., ¾–1 lin. lat.; capitula fructifera globosa, (exclusis spinis) 3 lin. diam.; achænia arcte conglutinata; spinæ 3 lin. long.†

6. *Acicarpa pinnatifida*, n. sp.;—herbacea, glaberrima, caulibus e basi pluribus, angulato-sulcatis, dichotome ramosissimis; foliis lanceolatis, membranaceis, utrinque glaucis, radicalibus imo cuneatis et in petiolum longum decurrentibus, pinnato-laciniatis, laciniis late triangularibus, obliquis, caulinis sessilibus imo cordato-auriculatis et semiamplexicaulibus, sinuato-laciniatis, supremis late linearibus, subacutis, mucronatis, integerrimis vel subdentatis; pedunculis axillaribus, folio multo brevioribus et oppositifoliis; involucri foliolis 5, anguste linearibus, patentibus, integris, mucronatis, subinæqualibus, pedunculo fere æquilongis, et floribus 3–6-plo longioribus.—Buenos Ayres, *v. v.*

Planta in pascuis copiosa, bipedalis; folia radicalia 6 poll. long., laciniis inclusis fere 1 poll. lat.; caulina sessilia, imo late et acute auriculata, lobis amplexicaulibus, 3–4 poll. long., 5–9 lin. lat., suprema sæpius integra, 1–2 poll. long., 3–6 lin. lat.; pedunculus 3–6 lin. long.; capitulum 6 lin. diam.; involucri foliola 3–4 lin. long., 1–2 lin. lat.; achænia in globum conglutinata, spinæ 3–4 lin. long.‡

7. *Acicarpa runcinata*, n. sp.;—subcæspitosa, humilis, caulibus

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* This plant is represented in Plate 51 c.

† Details of this species will be found in Plate 52 a.

‡ A figure of this plant will be seen in Plate 52 b.

paucis, scapiformibus, interdum nudis, rarius paucifoliosis, monocephalis; foliis radicalibus confertis, elongato-linearibus, irregulariter pinnato-laciniatis, laciniis grosse dentato-incisis et runcinatis, in petiolum alatum decurrentibus, membranaceis; capitulis terminalibus; involucri foliolis 5, spathulato-linearibus, elongatis, integris, obtusiusculis, patentibus vel reflexis, floribus 6-plo longioribus, subinæqualibus.—Banda Oriental, *v. s. in herb. Hook.* (Tweedie).

Planta pusilla, rami vix 2½-poll. long.; folia radicalia prona, radiantia, 1¼–2½ poll. long., laciniis inclusis 6 lin. lat., rachi alata 2 lin. lat., tenuiter membranacea, glaberrima. Caules scapiformes, suberecti, sæpius nudi, 1¼–1½ poll. long., monocephali, vel interdum foliiferi, 2¼ poll. long.; folia 2–3, alterna, 6–9 lin. long., 1–2 lin. lat.; capitula parva, 2–3 lin. diam.; involucri foliola 7–9 lin. long., 1 lin. lat.*

Observations on the Bignoniaceæ.

This beautiful family, the species of which impart a glory to the tropical forests of both hemispheres, but more especially to those of the New World, has been hitherto imperfectly investigated, and a more complete examination of the order is still a great desideratum in the science of botany. It has occurred to me that the few observations I made long ago upon several points of structure in this order may be of use in the pursuit of such an investigation; and in this hope the following remarks are offered as a small contribution towards that end. It is to be wished that some able botanist would take the trouble to re-examine carefully all the materials existing in the principal herbaria, re-model entirely the disposition of the order, determine the more essential characters and limits of the genera, and identify the species: he will find this labour amply rewarded by the interesting results which such an investigation will assuredly afford. At the time when Prof. Lindley published his 'Introduction' (in 1836), he remarked that the order "is in great confusion, and requires to be carefully revised by some good botanist." The renowned elder DeCandolle made the first step towards this inquiry in his 'Revue des Bignoniacées,' in 1838, and again, on a more extended scale, in his 'Prodromus,' in 1845; but the materials at his command at that time seem to have been far from complete; consequently we there find the greater part of the individuals of the family massed together in the genus *Bignonia*, all of which require sifting and separating into their proper places. This valuable contribution to the knowledge of the order in the 'Prodromus' was enriched by many notes relating to structural points of great importance, furnished by his eminent son, Prof. A. DeCandolle. Few additions to our knowledge of the family have been made since that time: among these may be mentioned those of Dr. Seemann on the *Crescentiaceæ* and some of the genera of the *Catalpeæ*: the attention of the same botanist has also been for some time directed to the study of the family; and it is to be hoped that he will publish the results of his investigations.

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* A drawing of this species is given in Plate 51 B.

The order is divided by DeCandolle into two tribes, distinguished in great measure by the presence or absence of winged margins to the seeds: in the former case (*Bignonieæ*) the fruit is capsular and dehiscent, with winged seeds; in the latter case (*Crescentieæ*) it is either fleshy or ligneous and indehiscent, with apterous seeds, often imbedded in pulp. I have already pointed out, in the former tribe, the anomalous instance of *Oxycladus* *, where the fruit is an indehiscent nut, normally 2-locular and pluriovular, but by abortion unilocular and monospermous, the seed being perfectly apterous, with two thick fleshy cotyledons conjoined by a very small terminal radicle. I indicated also another instance in *Adenocalymna*†, where, although the fruit is capsular and dehiscent, the seeds have no wings, their teguments being coriaceous and hard, and their cotyledons very thick and fleshy. In *Platycarpum* and *Henriquezia* the seeds are likewise fleshy and wingless. In *Argylia*, also, some species have the seeds quite apterous, in others the wing is only rudimentary. Thus it appears that this feature is not sufficiently constant to serve as a basis for tribual distinction. I propose in the following remarks to search for other characters, and with this view I will first notice several modifications I have observed in the structure of the seeds, and then inquire into the modes in which the carpels are combined.

In the *Bignonieæ* the seed usually consists of a coating, considerably flattened, with a coriaceous centre surrounded by a broad, delicately membranaceous wing, generally broader than long: it has no funicle, but near the margin of the coriaceous portion, contiguous to its base, a small linear hilum is seen, which corresponds with a similar cicatrix on the dissepiment, where it was attached. As an example of the general structure of the seed in the *Bignonieæ*, we may take that of *Pithecoctenium squalus*. Here it is surrounded by a very broad wing, of extreme tenuity, delicately reticulated, perfectly hyaline, with a number of strong nervures radiating from the coriaceous discoidal centre. After sufficient maceration, it is easy to introduce a blunt needle into the substance of the wing, when it can be separated into two very distinct laminæ, even to the utmost margin, proving that the wing, although in this case of extreme tenuity, is not a simple pellicle, as Prof. A. DeCandolle concluded (Prodr. ix. 142, note). The many radiating lines that diverge from the coriaceous discoid portion are formed by the plicature of the laminæ at those parts, evidently from the effect of pressure, for they contain no vessels of any kind, and have no connexion with the raphe. The discoid centre, where these laminæ are not conjoined, is quite hollow and opake, forming a distinct cell lined with a quantity of opake white cellular tissue; and the next integument lies in the centre of this space, filling about two-thirds of its diameter. This intermediate integument is somewhat opake, transversely oval, with a deep emarginature in its summit, reaching nearly to the centre; and in the bottom of this sinus the chalaza is clearly seen: at the base is another emarginature, of less depth, from the bottom of which proceeds a tube of the length of the whole tunic, which extends downwards to the basal hilum through the coriaceous portion of the winged integument, to the sides of which this tube is agglutinated by solid deposits; and in this manner it forms a semiseptum in the lower part of the coriaceous cell, which thus becomes bimarsupiate at its base. The third integument that immediately invests the embryo is thinner and of the same form as the intermediate coating, only that a very short sac surrounding the radicle occupies the place of the long tube. The embryo is of the same transversely oval form, and consists of two very flat foliaceous cotyledons, deeply cordate at base, with a very short obtuse radicle in the sinus that occupies half its length: in the summit is a similar emarginature that reaches the centre, thus cleaving the cotyledons almost in two, and leaving a very short space between the two emarginatures, so that the embryo appears almost to consist of four cotyledonary lobes. The semiseptum above mentioned coincides with the line of the simple raphe that is imbedded in the ventral discoid lamina of the outer winged tunic, but has no connexion with it more than is due to the subsequent agglutination of the parts. The raphe, starting from the hilum, follows the course mentioned, imbedded in the outer lamina, until it arrives opposite the apical sinus of the embryo, when it suddenly pierces its way through the coriaceous deposits of the tunic, and immediately communicates with the chalaza.

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* Linn. Trans. xxi. 145; Linn. Proc. ii. 270.

† Linn. Proc. ii. 272.

It is thus seen that the embryo in the *Bignonieæ* usually consists of a very short radicle seated in the basal sinus of two very deeply lobed cotyledons, which are again 2-lobed at their summit: this form is subject to several modifications, one of the most remarkable of which is found in *Argylia,* where the embryo appears cleft only at the base, being quite truncate at the summit; but this scissure extends from the base to the very apex. The embryo is thus divided into four equal lobes, greatly flattened, foliaceous, and lying in adpressed pairs, free all round their margins, but united together at a small point to the very apex of the terete accumbent radicle, which is of the length of the lobes, and lies recondite in the centre, concealed by the free margins of these lobes : this radicle, which points to the basal hilum, is placed transversely and centrifugally in regard to the axis of the capsule, as in most genera of the family. The cavity of the coriaceous integument which encloses it is nearly orbicular or transversely oval, though sometimes much compressed, without any tendency to the formation of a semiseptum at its base, as occurs in many genera. The reason of this is that the neck of the intermediate integument is not agglutinated to the sides of the outer tunic, but remains free; and in *Argylia* this neck is extremely elongated, indeed longer than the integument itself, so that it is coiled up into a shorter space, much in the same way that Dr. Wight represents it in *Calosanthes* (Icon. tab. 1339, upper figure).

There are some exceptions to the occurrence of this deep emarginature of the cotyledons,—for instance, in *Calampelis*, where the embryo assumes the ordinary form of two simple cotyledons, nearly orbicular, compressed, and foliaceous, with a short, terete terminal radicle, all united together at their slightly cordate base. In *Oxycladus*, and probably also in *Monttea* and *Reyesia*, the embryo is similarly developed, the cotyledons being simple, oval, very thick, and fleshy, with a short terminal radicle. In *Platycarpum* and *Henriquezia*, the cotyledons are simple, thick, fleshy, and transversely elongated, with a deep hollow upon their inner face, at their true base (or apparent side), in which the radicle lies concealed. In *Crescentia, Sesamum, Pedalium*, and their congeners, the embryo is constructed as in *Oxycladus* and *Calampelis*. In the *Cyrtandraceæ* the embryo is said to be terete, with cotyledons shorter than the radicle.

In *Anemopægma*, however, where the embryo is of the form described in *Pithecoctenium*, we find not only the broad membranaceous wing, but the coriaceous discoidal portion also, cleft at its summit; so that the tunics become bilobed, and as it were 2-celled at that extremity, and the apices of the cotyledons nestle in these spaces: but although the base of these tunics has no such corresponding cleft, we find there a short transverse septum, as before explained, connecting the dorsal and ventral faces of the integument; and within the two marsupial pouches so formed the lower lobes of the cotyledons are isolated and enclosed.

This structure is carried to the utmost extreme in *Adenocalymna*, where the seeds are not highly compressed, as usual, but are very thick, nearly circular, with a hard, polished, crustaceous covering, without any membranaccous wing, and with only the sharp angular edges produced by the strong mutual pressure of growth: had they been relieved from this pressure, their shape would have been nearly spherical. A longitudinal section of one of these seeds shows, within the thick coriaceous testa, a nearly circular space, which is divided by a broad septum into two equal complete cells: this septum is entire throughout, except a very small linear foramen in the centre, which aperture is filled by the central radicle of the embryo, while the space of the two cells is occupied by the cotyledonary portion, which is divided into four equal lobes, as in the instances before described: these lobes are thick and fleshy, plano-convex, in contiguous pairs, and are united by the central short terete radicle, the extremity of which is centrifugal, pointing to the large broad basal hilum.

In *Spathodea campanulata* the 4-celled capsule is represented by Palisot de Beauvois* as having numerous orbicular lenticular seeds, with a narrow wing, all packed together in a horizontal position, as in *Calampelis* (not parallel to the dissepiment), and attached to the inner angle of each cell by a linear hilum along its truncated margin, and this margin is somewhat induplicated within the testa. The embryo is shown to be formed of four cotyledonary lobes attached to the apex of the terete radicle equal to them in length, as in *Argylia*; they are not spread out in opposite pairs, as in that genus, but are folded and parallelly superposed upon one another, their outer margins lying in pairs right and left of the induplicature of the testa, the cross-section of its internal space being thus hippocrepiform: the radicle is placed in contiguity to this semiseptum, so that the edges of all the four cotyledonary lobes are thus accumbent upon it and close to the line of the raphe. A similar induplicature of the cotyledonary lobes is figured in Delessert's 'Icones' (v. tab. 93 B), in *Kigelia*, a genus of *Crescentiaceæ*.

In *Stereospermum chelonoides* (taking Dr. Wight's analytical figures† for guidance, the correctness of which I am able to verify), the integuments of the seed are inflected, by a deep plicature, into the dorsal face, and thus produce a transverse semiseptum within the discoidal portion, in a contrary direction to that of *Anemopægma*: this protrudes into the middle of the cavity of the crustaceous integument. The cotyledons are cleft almost to the base, and are folded as in the last instance, so that their four lobes lie with their external edges in pairs on each side of the semiseptum, and in this manner are lodged in the incomplete cells so formed: the internal edges of the lobes thus become accumbent on the radicle, which corresponds in direction with the line of the raphe. The radicle is consequently transverse as regards the axis of the capsule, being neither centrifugal nor centripetal, but horizontal and parallel to a diametral line drawn across the axis of the fruit, and its free extremity points to a small hilum on the integument.

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* Flor. Owar. tab. 28.

† Icones, tab. 1341.

From these facts it is clear that, generally, the seeds of *Bignoniaceæ* are furnished with three distinct integuments. The broad wing is a real tunic, being part of an extremely lax testa, often enlarged to ten times the diameter of the intermediate coriaceous coating, its sides becoming agglutinated together by pressure into the form of a delicate wing: it is proved to be the real testa by the passage of the cord of the raphe through its tissue along its ventral face, which cord does not enter into the substance of the second tunic until it pierces its way through it, in order to arrive at the chalaza of the inner integument. The intermediate, more or less coriaceous integument, with its very elongated, narrow neck, which is sometimes coiled up and free, and at other times hardened and adherent in the form of a septum, must be considered to be a development of the secundine, while the inner integument, with its mouth converted into a short sac, must be viewed as a product of the tercine; it cannot be a very thin albumen, because it fits too loosely upon the embryo, and because it is provided with a distinct chalaza.

The few observations I have made relative to the structure of the carpels may not be uninteresting in this inquiry. Prof. DeCandolle, to whom we owe the best monograph of the family, has divided his tribe *Bignonieæ* into four subtribes:—1. *Eubignonieæ*, where the flattened and elongated capsule is 2-valved and opens by two sutures along the lateral margins, having the dissepiment parallel to the valves, which separate from it, showing numerous imbricated seeds attached to it, in one or more rows, near its two margins on both faces. This subtribe is again formed into divisions (*Monostictides* and *Pleiostictides*), according to the number of series of seeds on each margin of the dissepiment. 2. *Catalpeæ*, where the capsule is also bilocular and bivalvular, but where the dissepiment lies across both valves at a right angle: the capsule here opens by two sutural lines, as in the preceding subtribe, and the dissepiment separates from the middle of the two valves; the seeds are attached to the dissepiment, as in the former case; and the subtribe is again subdivided in like manner, according to the number of series of the seeds. 3. *Incarvilleæ*, where the capsule has either one or two cells; in the latter case, as in *Amphicome*, each cell opens by a simple suture, and the valves remain attached to the dissepiment, which is placentiferous in the axis on both faces: in *Incarvillea* the capsule is also bilocular, and it splits into two valves, with a contrary dissepiment, which becomes quite free from them, upon the lateral margins of which the seeds are attached on both faces,—a structure quite that of the *Catalpeæ* : there is therefore an inconsistency in this small group, to which I will presently refer. 4. *Eccremocarpeæ,* where the capsule, though bivalvular, is unilocular, the seeds being affixed upon a prominent linear placentation that runs along the middle of each valve. This subtribe consists only of the genus *Eccremocarpus,* but the structure of its capsule and placentation differs in no way from that of *Jacaranda,* which is placed in the *Catalpeæ;* if therefore this subtribe be maintained, *Jacaranda* must be transferred to it.

In the first subtribe, the structure above defined, as regards the capsule, is universal. In the *Monostictides* the dissepiment is generally thin and coriaceous, but in the *Pleiostictides* it is thick and almost ligneous, in both cases consisting of two parallel plates firmly conjoined together, and which frequently may be separated: when the seeds fall away, we may observe upon it the lines of cicatrices distinctly marked on both sides, near to and parallel with the margins, thus indicating the points of attachment and number of series of the seeds. In *Amphilophium Vautherii,* for instance, these parallel plates easily come apart; the dissepiment is at the same time marked by a nervure along its axis, showing where the carpels have been conjoined; the imbricated seeds are attached near the margins, in four parallel rows (that is to say, sixteen series in all the four marginal surfaces), and the points of their attachment are marked by long deep furrows, which, being close to one another and alternating, give to the margin the appearance of being cancellated by a lattice-work of coarsely reticulated open spaces. A similar appearance is seen in *Pithecoctenium,* where the margins of the plates are severally turned up at a right angle, like the edge of a tray, and this reflected portion is cancellated in the same manner, showing there the points of attachment of the seeds.

In most of the *Eubignonieæ,* as in *Adenocalymna, Arrabidæa, Amphilophium, Anemopægma, Pithecoctenium,* &c., the two valves of the capsule, upon falling away, leave upon each side of the dissepiment (which remains attached to the peduncle, though at some distance from it) a concentric line of ligneous fibre, or replum, like that seen in the fruit of the *Capparideæ,* but which cords do not remain attached to the placentæ or seeds as in that family. These replum-like cords, which, before the dehiscence of the capsule, produce lateral ridges by intervening between the margins of the valves, remain attached at their base to the peduncle, and often at their other extremity to the apex of the dissepiment. In *Cybistax,* where the dehiscence is in the middle of the two faces, no such replum becomes manifested, as might be expected; nor does it exist among other genera of the *Catalpeæ*, the *Incarvilleæ*, or the *Eccremocarpeæ*. This replum, which results from the union of the adjacent midribs of the conjoined carpels, though simple in *Pithecoctenium* and *Amphilophium*, splits into two in most of the genera.

In the second subtribe, the *Catalpeæ*, the seeds are not affixed near the edges of the valves, as in the preceding group, but close to a line down their middle, where they are attached to the margins of the narrow transverse dissepiment; the latter is at first united to the valves, but it afterwards separates from them, bearing upon each face a single series of seeds placed alternately on the right and left. The same occurs in *Argylia*, where the seeds are attached in that manner—not along its median line, as incorrectly represented in Endlicher's 'Iconographia,' tab. 71. It sometimes happens in this group that a septiform extension of the dissepiment takes place nearly across the cellular spaces, so that the capsule becomes apparently 4-celled; this occurs in *Sparattosperma*, *Spathodea*, and *Heterophragma*, where the cruciform dissepiments thus formed are greatly thickened, and occupy nearly the whole capacity of the valvular spaces. It is well to observe that in these cases the two longer arms of the cruciform dissepiment terminate at the sutural commissures of the capsule, the two shorter ones in the middle of the valves, and that the seeds are borne by the latter: the ovary, at an early stage, is bilocular, when the dissepiment, which is transverse, appears much swollen in the axis, where it is not ovuligerous, but the ovules are affixed on each side of the axial line: it is this barren axial portion that subsequently extends in a cruciform direction, ultimately reaching the commissures of the valves. These indications are of use as leading to a knowledge of the normal structure. In *Stereospermum* a curious but analogous increment takes place: the ovary is 2-locular, with a thin dissepiment, and with numerous ovules remotely placed in distinct series; the capsule is cylindrical, very elongated, 2-valved, the central space being now filled up with a solid plug of a cork-like substance, in transversely articulated, separable, vertebra-like sections, in each of which a single seed is imbedded, attached by its hilum to the bottom of its foveolar nest, with its two wings extending upwards and downwards rectangularly along the inner face of the valves: these seminiferous cavities are placed alternately in the middle of the four quarters, indicated by four narrow longitudinal cicatrices that run down the entire plug, showing the lines of its attachment to the middle of the two valves, and where it has touched their sutural margins. It would seem that a very analogous structure exists in *Parmentiera*.

On the other hand, in some few genera, as in *Jacaranda, Fridericia, Eccremocarpus,* and *Calampelis,* there is no actual dissepiment, but the placentations are parietal along the middle of two parallel valves, which lines of placentation nearly touch one another, but do not meet in the axis: this linear placentation projects but little above the surface of the valves, and is reflected right and left into narrow plates parallel with the valve, which plates are crenately lobed, each lobe bearing a seed. In *Jacaranda* the seeds are arranged parallel to the valves. In *Eccremocarpus* (I speak rather of *Calampelis,* which has sufficient claim to be generically distinct) the seeds are more imbricately pendent. In *Fridericia* the structure of the capsule and seeds completely agrees with that of *Jacaranda.*

It has been held as a general rule that, throughout the order, the direction of the radicle is centrifugal in regard to the axis of the fruit: this is true in all the *Eubignonieæ,* and in such genera of the *Catalpeæ* as have a simple transverse dissepiment; but many exceptional cases occur. The instances of *Spathodea* and *Stereospermum* have already been mentioned (p. 160), where the radicle is neither centrifugal nor centripetal, but lies in a transverse direction parallel to the diameter of the fruit: a similar direction exists in *Sparattosperma* and *Heterophragma*: in *Jacaranda* it has the same position, while in *Calampelis* it is almost centrifugal. On the other hand, in *Platycarpum* and *Henriquezia* the radicle is decidedly centripetal, as I have shown it to be in certain species of *Spathodea.* In *Oxycladus* its direction is equally abnormal: here the ovary is bilocular, and the ovules, all heterotropal, are in a divaricating position, placed in collateral pairs down the middle of the dissepiment, with the micropyle directed to the axis. One of the cells becomes abortive, and in the other one only a single superior ovule becomes perfected, which occupies the entire space of the cell, and by the pressure of growth thus becomes pendent, so that the radicle is neither centrifugal nor centripetal, but points to the apex of the fruit.

Having brought together these facts, we are better prepared to inquire into the construction of the carpellary arrangement in the *Bignoniaceæ.* We find here, generally, an ovary formed of two cells separated by a complete dissepiment, a simple style, and a stigma consisting of two dilated lamellæ, corresponding most frequently in position with the cells. Upon this *prima-facie* evidence, the inference would naturally be that the normal number of its carpels must be two; but when we come to inquire a little further, we find great difficulty in accounting for the mode of dehiscence of the capsule and the position of the seeds on the dissepiment, upon this hypothesis. We must bear in mind that the normal carpellary leaves would be ovuligerous either on their margins or on their midribs : if on their margins, supposing them to be only two in number, how are we to account for the production of a thick dissepiment, which could have formed no part of such original carpels ? if on their midribs, the same objection supervenes, unless we imagine that the midrib of each carpel grew out in the form of a septum, both of which, uniting by their edges, might constitute the dissepiment; but such kind of growth is contrary to the usual law of development, and, upon examination of the ovary in its earliest stages, there is no appearance of its having taken place. Such a conjecture may therefore be dismissed, because it is quite unsupported by rule or evidence.

Fig. 1.

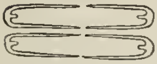


Fig. 2.

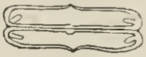


Fig. 3.

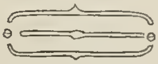
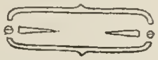
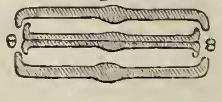


Fig. 4.



We may, however, satisfactorily explain the morphological changes that have taken place in *Eubignonieæ* upon the hypothesis that the ovary is normally composed of four carpels with sterile margins, and which are ovuligerous on their midribs, all severally plicated and arranged in opposite pairs, as in fig. 1 : these, by the confluence of their sterile margins and adjacent faces, would constitute a bilocular ovary, such as we find it in *Bignonia* and its congeners, with the ovules fixed, not in the axis, but in the marginal angles of the two cells (fig. 2). We may in this manner account for the separation of the two valves of the capsule from the dissepiment close to the four lines of placentation, and also for the production of the replum before described, which originates in the union of the midribs of the normal carpels (fig. 3), that sometimes remain agglutinated together (as in *Pithecoctenium*), sometimes become divided in two (as in many other genera). This view is further confirmed by the fact observed in *Peltospermum*, where the dissepiment is fenestrated at its apex for one-third of its length, and nearly its whole breadth (as in fig. 4), by a very large aperture, which no doubt is caused by the incomplete junction of the edges of the normal carpels where they meet together to form the septum, in the manner shown in fig. 1. This fact presents the strongest argument in favour of the view here taken. In *Tanaecium*, *Distictis*, and probably in *Dolichandra*, where, as in *Bignonia*, the dehiscence is marginicidal, the valves are partly split down their middle, thus partaking of both kinds of dehiscence. I do not see how we can explain the development that takes place in the *Eubignonieæ* under any other hypothesis. We find a striking evidence in favour of this conclusion in the fruit of *Pithecoctenium*, of which mention has been previously made. Here the seeds are affixed upon a broad, prominent zonal reflexion formed round each margin of the thick dissepiment, which, as we have seen, is separable into two plates; and the thick valves at the line of their separation are seen to be respectively moulded around these seminiferous inflexions, leaving the replum on each margin free both from the valves and the dissepiment, though still connected with the latter at its base and apex (fig. 5).

Fig. 5.



This conviction is more forcibly confirmed by the examination of the ovary in the *Eubignonieæ*. Upon the fall of the corolla, we find the ovary grown to a length a little exceeding that of the calyx, and compressed as usual, with a deep groove along each edge coinciding with the margins of the dissepiment, which there bears the ovules close to that line, at the furthest possible distance from the axis; upon each face is a prominent line, which is continued up the style: this structure is shown in fig. 2. The same appearance is observed in the ovary, in a very early stage of the bud, long before the anthers are perfected; we have then the same deep marginal inflexion, showing the line of confluence of the component carpels, as in the manner shown. The stigma consists of two broad petaloid lamellæ, which are smooth within, and apparently are not provided with the usual papillose stigmatic surface, which here seems to reside in the infundibuliform mouth of the style: this is hollow for half its length, and on each side dark longitudinal lines are distinctly seen, which appear to correspond with the stigmatic channels in communication with the four placentiferous lines of the ovary: the longitudinal line seen upon each face of the ovary is continued along the style, in the form of a nervure, through the middle of the stigmata, and on each side of this nervure the dark lines just mentioned are distinctly seen. These appearances are all confirmatory of the assumption that the ovary is composed of four carpels combined in the manner previously shown; and we may also infer that each lamella of the stigma is composed of two confluent stigmata. The occurrence of a bifid stigma, with four united carpels, at first thought might be considered to be an improbability; but we must remember that it is no unusual combination, for it is constant in the extensive families of the *Ehretiaceæ*, *Borraginaceæ*, and *Labiatæ*, and also frequent in *Verbenaceæ*.

In the *Catalpeæ*, where the capsule is loculicidal, the dissepiment being contrary to the valves, which separate from it, there is evidently a different structure, the nature of which may probably be more readily understood from the examination of the ovary. This is here compressed, as in the former tribe, 2-celled, with a precisely similar style and stigma; but the dissepiment is not, in like manner, parallel to its two faces, but, contrariwise, transverse, its ovuligerous margins corresponding with the antical and postical longitudinal ridges; the cells, therefore, instead of being anterior and posterior in regard to the axis, stand on its right and left, so that the stigmata are contrary to the cells: the ovules, in two series, are borne upon the dissepiment (in *Tecoma ochracea*) (fig. 6), not along the axis, but, as in the former instance, at the utmost distance from it. Now, in this case the ovary may be assumed to be constituted either of two carpels, ovuligerous on their midribs, and placed back to back, as in fig. 7; or it may be formed of four carpels arranged somewhat as in the *Bignonieæ*, but differently disposed, as in fig. 8, the sterile margins being afterwards united, and the adjacent faces becoming confluent. Upon comparing these figures, it will be seen that the former view must be rejected, because, under that hypothesis, the ovules ought to be found arranged along the axis; and the latter view must be adopted, because it satisfactorily accounts for the position of the ovules in the ovary and of the seeds in the fruit. Owing to a somewhat different inclination of the carpels, as shown in fig. 9 (which will be seen to be a modification of fig. 8), the ovary and fruit become 4-locular in *Heterophragma*; and the resulting form of fruit is shown in fig. 10, where the dissepiment is cruciform, with two longer and two shorter arms; the latter, bearing the seeds 3- or 4-serially on both sides, terminate in the middle of the valves, the former touching the sutural and dehiscent margins of the valves. When the valves open, the corresponding barren portion of the dissepiment becomes split across into two longitudinal halves, each half bearing the seminigerous portion of the dissepiment in the form of the letter **T**, which at the same time detaches itself from the middle of the valve. We see here the most complete verification of the hypothesis above suggested of

Fig. 6.

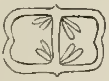


Fig. 7.

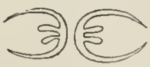


Fig. 8.

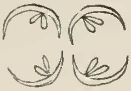


Fig. 9.

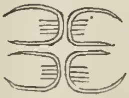
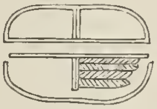


Fig. 10.



the carpellary constitution of the ovary and fruit in the *Catalpeæ.* In some species of *Spathodea,* in *Stereospermum,* in *Parmentiera,* and partially in *Sparattosperma,* the dissepiment seen in fig. 6 becomes swollen and enlarged by solid deposits into a cylindrical plug, which nearly fills the entire cavity of the two valves, the body of the seeds being left imbedded in corresponding cavities of the plug (as in fig. 11), while the wings remain pressed against the inner face of the valves. In *Spathodea falcata* and in *Spathodea alternifolia,* the capsule is much compressed, and the dissepiment, instead of being cylindrical, is greatly flattened, though still filling the entire space formed by the two valves: this dissepiment is deeply sulcated along the middle of both faces, almost to the centre, the groove being divided by an extremely narrow ridge, the margins of which are attached to the middle of the valves, from which they afterwards separate: this ridge is an extreme abbreviation of the shorter seminigerous arms of the cruciform dissepiment described in *Heterophragma* (fig. 10), and is in like manner seminigerous; it contains the same placentary threads which are seen in the centre of the large cylindrical plug of *Stereospermum chelonoides.* In a section of the dissepiment of *Spathodea falcata* (fig. 12) there are seen two of the deep cavities alternately formed in it upon each side of the ridge, each of which cavities is filled with a single seed attached by its marginal hilum to the ridge. From this arrangement it is seen that the seeds are strictly centripetal, the radicle of the embryo pointing to the axis of the fruit, contrary to the usual disposition of the order. These several developments therefore may all be referred to one simple normal structure, different from that of the *Bignonieæ;* and the *Catalpeæ* thus constitute a second very natural tribe.

Fig. 11.

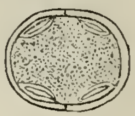
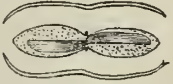
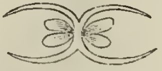


Fig. 12.



From the last-mentioned group, as indicated by DeCandolle, we must exclude *Platycarpum* (and, of course, *Henriquezia*), as it is evident that their ovary is constructed of two carpels only, which, though placentiferous on the midrib of their folded carpellary leaves, as in the two preceding divisions, are differently placed in regard to each other; for the midribs of the carpels are disposed back to back, as in fig. 7, and conjoined so as to form a bilocular ovary, as in fig. 13, with the placentation in the axis and the ovules fixed in the angle of each cell: the fruit thus resulting is a 2-celled loculicidal capsule, the valves remaining attached to the axis, and the cells opening along the sutural line of the sterile margins of the carpels. In this group the

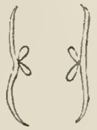
Fig. 13.



anomalous genus *Oxycladus* will naturally find a place, as also the *Monttea* and *Reyesia* of Gay*—genera evidently allied very closely to it, but of which little is yet known. We have thus a third natural tribe, the *Platycarpeæ.*

I have already described (in p. 50) the development that takes place in the fruit of *Jacaranda,* which is quite analogous to that of *Fridericia, Calampelis,* and *Eccremocarpus.* Here the ovary, as in the *Platycarpeæ,* is normally constituted of two carpels only, which are in like manner placentiferous on their midribs, but they are differently arranged, being placed with their placentiferous lines opposed to each other, and conjoined by their sterile margins, as in fig. 14. The ovary is therefore unilocular, with two opposite longitudinal parietal placentæ, and the result is a compressed, 1-celled, 2-valved capsule, with the seeds attached to the middle of the valves, which open along the sutural line of union of the original carpels. These genera thus constitute a fourth very natural tribe, the *Eccremocarpeæ,* a group of greater extension than the subtribe of the same name of DeCandolle.

Fig. 14.



It appears to me that the fourth subtribe of DeCandolle, the *Incarvilleæ,* cannot be maintained. That group consists only of *Incarvillea* and *Amphicoma.* In regard to the former genus, I am able to confirm the accuracy of the details given by Correa da Serra (Ann. Mus. viii. 391, tab. 63. fig. 2), which prove that the structure of its fruit and the position of the seeds, in the only known species, are precisely the same as in *Argylia,* which has been noticed in page 160. The resilient process often observed in the anthers, which seems like an arista, has been urged as a distinctive character; but this arises (as was long ago indicated by Mr. Brown, Pl. Jav. Rar. 111), not from any emanation of the connective, but from the rending of the thickened nerve-like sutural margins of the anther-cells, which separate at the base and remain attached at the apex, as I have shown to occur in *Argylia.* It was upon this circumstance that Presl was induced to found his *Oxymitra,* a genus which cannot stand. A similar resilience in the anther-cells is occasionally met with in other Bignoniaceous genera, for instance in the *Pyrostegia* of Presl (*Bignonia venusta*). The general habit of *Incarvillea* is quite that of *Argylia,* as is acknowledged by DeCandolle; and there is a remarkable similarity in its leaves, which are in like manner bipinnatisected, with linear segments; it has also a terminal raceme, with large handsome crimson flowers. *Incarvillea,* therefore, may safely be placed among the *Catalpeæ,* and near *Argylia.*

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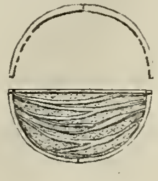
* Gay, Chile, iv. 416, tab. 51; *ibid.* 418, tab. 52; Walp. Ann. iii. 92, 93.

In *Amphicoma* the capsule appears differently constituted from that of *Incarvillea*, as before shown; and in several other respects the genus is at variance with *Bignoniaceæ*: it seems more conformable with *Cyrtandraceæ*, as Mr. Brown long ago indicated (*loc. sup. cit.*); in the structure of its flower it quite agrees with that family, especially in its stamens with large appendiculate connective, which in *Bignoniaceæ* is not so strongly developed; its fruit is also in perfect accordance with *Cyrtandraceæ*, particularly in its long comose seeds, which are pendent (not transverse), with a superior (not centrifugal) radicle. The genus, at one time placed in *Cyrtandraceæ* by DeCandolle, was afterwards removed, in great measure on account of its divided leaves; it must, however, be remembered that it agrees better with the last-mentioned family in its herbaceous habit and general aspect, and that if in *Cyrtandraceæ* the leaves are not pinnatisected, they are only one degree removed from this condition in their deeply and unequally serrated margins.

Before I dismiss this inquiry into the carpological structure of the *Bignoniaceæ*, I will mention a novel and interesting form of development which I have noticed in a fruit brought from Jamaica, and now in the Collection of the British Museum, where there are two specimens, collected by different individuals at distant periods, from which we may infer that the plant which produces it is not of rare occurrence in that island. It is to be regretted that these fruits are not accompanied by any dried specimen of the plant from which they were gathered. I have no doubt that it is the fruit of *Tanaecium albiflorum*, DC. (*Tanaecium Jaroba* of Swartz, and the *Cucurbitifera fruticosa*, Sloane), agreeing in every essential respect with the account given of it by Swartz. The specimen I have seen is 6 inches long (according to Swartz sometimes a foot in length), $2\frac{1}{4}$ inches in diameter, and nearly circular in its transverse section; it splits into two valves of a solid ligneous texture, about $\frac{1}{8}$ inch in thickness; it has a rather thin coriaceous dissepiment, quite smooth on both sides, parallel to and quite free from the valves, and a bipartible compressed replum, which lies between the margins of the valves; these valves partly split down the middle, as in *Distictis* and *Dolichandra*: the two cells are filled with a great many irregularly orbicular and compressed seeds, much resembling those of *Adenocalymna*, closely packed together and imbricated, apparently without the least trace of intervening pulp (fig. 15): the outer tunic of each seed is hard and smooth, and is truncated on one side by a straight marginal edge, forming an oblong

Fig. 15.



linear hilum, by which it is attached to the inner face of the valves; upon this face, along the margins of each valve, there is seen a broad longitudinal seminiferous zone, leaving the intervening portion, which is as broad as the two zones united, covered with a polished yellow endocarp: these seminiferous zones are marked with a number of dark, rough, oblong cicatrices, placed alternately in three or four parallel series, which correspond with the hilar points of attachment of the seed, as in *Pithecoctenium*. From this it will be seen that the attachment of the seeds is strictly parietal—a feature hitherto novel in *Bignoniaceæ*. This circumstance has probably led botanists to suppose that it belonged to the *Crescentiaceæ*, as it resembles *Crescentia* in its hard shell, of similar shape and size; but as it is decidedly 2-valved and dehiscent, has a perfect and free dissepiment, with a distinct replum, and quite devoid of pulp, it is strictly *Bignoniaceous* and belongs to the tribe *Bignonieæ*, differing in no respect except in its parietal placentation. It should be observed, however, that the direction of the seeds and their attachment by a marginal hilum, precisely in the same position, occur in *Pithecoctenium* (see fig. 5, page 52); but in the latter case the zonal bands of placentation remain fixed at a right angle to the inflected margins of the free dissepiment, whereas in this fruit they are attached to the valves: in all other respects there is a perfect agreement between the two cases. The structure of the seed and the form of its integuments in this instance are precisely as I have described them in *Pithecoctenium*, the testa being in like manner bimarsupiate at the base of its discoid cell by a short septum; and in the recesses thus formed the lower portions of the embryonary lobes are sheltered. In *Pithecoctenium*, the broad expanded part of the testa which forms the pellucid winged margin around its discoidal portion is of the same extent as in the fruit under consideration; but, in the latter case, it is filled to its extreme edge by a thick deposit of cellular tissue between its faces, so that it loses its transparent character, and becomes thick, hard, and coriaceous, as in the seeds of *Heterophragma*: the inner integuments, which closely invest the embryo, are about half the length and half the breadth of the testa.

I shall presently recur to the genus *Tanaecium* of Swartz, respecting which a strange degree of confusion has existed.

The group of the *Crescentiaceæ* merits observation in this inquiry: it was considered by Jussieu, Endlicher, and DeCandolle to be a tribe of the *Bignoniaceæ*. Gardner first proposed it as a distinct family, which view was adopted by Prof. Lindley; and lately Dr. Seemann has supported this opinion. DeCandolle divided it into two sections—the *Tanaecieæ,* possessing a bilocular ovary, and the *Crescentieæ,* a 1-celled ovary—all being distinguished from the *Bignonieæ* by their indehiscent fruit and apterous seeds. Dr. Seemann, in maintaining its claims to rank as a distinct family, also separates it into two sections under the same names*; but he simply distinguishes the *Tanaecieæ* by a persistent, and the *Crescentieæ* by a deciduous calyx; and he affirms, contrary to the statements of preceding botanists, that all alike possess at an early stage a unilocular ovary with parietal placentations, the fruit becoming bilocular by the subsequent enlargement and confluence of the placentæ: this view is not confirmed by the analyses I have been able to make, and, as regards the *Tanaecieæ,* is not supported by the evidence on record, which I here reproduce.

First, as respects *Colea,* the several details of *C. Mauritanica* (Bot. Mag. tab. 2817), of *C. Telfairii* (*ib.* tab. 2976)†, and of *C. floribunda* (Bot. Reg. v. 27, tab. 19), all prove most distinctly the presence of a broad membranaceous wing around the seeds, as in *Bignonia;* and the capsules, though covered by a somewhat fleshy epicarp, indicate, by well-marked grooves, the sutural lines of their dehiscence into two valves. Prof. Lindley has remarked that no instance is known of the existence of winged seeds in indehiscent pericarps; for as the function of the wing of the seed is to carry it from a height to a long distance by the force of the wind, this object could not be effected were the fruit indehiscent. *Colea,* with its winged seeds in a 2-valved capsule, and its ecirrhose pinnated leaves, may probably find its place near *Tecoma,* among the *Catalpeæ;* but if, as Sir Wm. Hooker states, the valves of its capsule be parallel to the dissepiment, it must belong to the *Bignonieæ.* In regard to the structure of the ovary in *Colea,* Prof. A. DeCandolle found it to be distinctly bilocular. We have not as yet sufficient knowledge of the structure of *Phyllarthron* and *Periblema* to enable us to judge of their true position: in the latter the ovary is bilocular, with only two ascending ovules in each cell, attached to the dissepiment, and the calyx is enclosed in a tubular ventricose 4-fid involucre, which characters, as Prof. DeCandolle remarks, are quite foreign to the order. Of *Phyllarthron* very little is known. Even in regard to *Tanaecium,* our information concerning the structure of the ovary, fruit, and seed, as far as has been heretofore known, has not been sufficiently positive. The genus was established by Swartz upon two species so dissimilar in floral organization, in the size and form of the fruit, in their habit, and in the shape of their leaves, that he classed them together with great doubt. DeCandolle and other succeeding botanists have not attempted to disassociate them; but when another species, closely allied to *T. parasiticum*, was first described by Miquel, he made it the type of a new genus, calling it *Schlegelia lilacina.* Prof. DeCandolle, however, expresses a doubt whether it be sufficiently different from *Tanaecium* to claim a generic distinction: this remark is true as respects *T. parasiticum*, which is certainly congeneric with it. Now, if we compare the drawings of Swartz of his *T. albiflorum* (Fl. Ind. Occid. tab. 20) and of *T. crucigerum* (Plum. Am. tab. 254), on the one hand, with *T. parasiticum* (Sw. *icon. cit.*) and with *T.* (*Schlegelia*) *lilacinum*, Miq. (Aubl. Guian. tab. 254), on the other, no one can doubt that the two former species are generically distinct from the two latter. In the former group the plants are scandent, their leaves conjugate, with a long cirrhus, as in *Bignonia*; the calyx is green, long, and tubular; the corolla is white, pubescent within and without, with a very narrow hypocrateriform tube, of unusual length (6 or 7 inches), with an undulately crispate 5-lobed border; the stamens and style (of great length) are exserted; the anther-lobes are linear, widely divaricated, with a terminal excurrent connective; the fruit is very large, oblong, often a foot in length; and the seeds are large, broad, compressed, and not imbedded in pulp. In the latter group the stem is radicant; the leaves are quite simple, as in many of the *Catalpeæ*; the calyx is coloured, short, and globosely campanulate; the corolla is deep violet or purple, quite glabrous, scarcely more than $\frac{3}{4}$ inch long, much swollen and ventricose above a short basal constriction, with an oblique bilabiate border, the upper lip of which is erect, bifid, scarcely cleft to the base, and the lower lip is trifid, reflected, with the middle lobe considerably the largest, and enveloping all the others in æstivation; stamens and style only half the length of the short corolla, and of course included; anthers very small, ovate, white, with nearly parallel lobes; fruit globose, only $\frac{3}{4}$ inch diameter in one species, and not more than $\frac{1}{4}$ inch in the other, with projecting seminiferous placentæ, rendering it falsely 2-locular, as in *Kigelia*, and containing numerous minute, angular, oblong seeds enveloped in pulp. These characters are severally as opposite as possible, rendering it evident that *Schlegelia* is not only generically distinct from *Tanaecium*, but appertains to a different family. The former genus manifestly belongs to *Crescentiaceæ*, while *Tanaecium* will probably find its place near *Adenocalymna* in *Bignonieæ*, because it possesses a similar habit, has the same kind of cylindrical elongated fruit, as we have seen (p. 56), and its seeds are, in like manner, large, apterous, and closely packed together, without intervening pulp.

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* Bot. Herald, 181; Proc. Linn. Soc. ii. 269.

† If the presence of a wing on the seed of *C. Telfairii* be questioned, there can be no doubt of its existence in *C. floribunda.*

The remaining genus, *Parmentiera,* placed by DeCandolle near *Tanaecium* on account of its bilocular ovary and indehiscent fruit, is referred to his tribe *Crescentieæ* by Dr. Seemann, who, in detailing its generic character, affirms that the ovary is at first unilocular, but that by the enlargement of the placentæ it becomes 2–4-locular in the fruit*; but he nowhere states that he had examined the ovary or had witnessed the organization just mentioned, and we may infer that he copied this character from DeCandolle's account of the fruit of *P. edulis,* a description framed entirely upon the drawing and descriptions of Mocino and Hernandez. It is to be regretted that in the excellent drawing of *Parmentiera cerifera* (Bot. Herald, pl. 32), no figure of the structure of the ovary is given; but it will be there seen how remarkably that plant agrees in the peculiar shape of the spathaceous calyx and the form of the corolla with *Spathodea,* and scarcely less so in the shape of its cylindrical siliquose fruit, which, according to that drawing, is evidently 2-valvular, with numerous small apterous seeds, not enveloped in pulp, but fixed to a greatly enlarged central dissepiment that nearly fills the whole space within the valves, precisely as in the genus last mentioned and in *Stereospermum.* Dr. Seemann mentions that the fruits of *P. cerifera* are given as food to cattle, when mixed with Guinea-grass and a kind of sweet potato, but does not say which part of the fruit is eaten: this probably is the pericarpial or valvular covering, which he defines as a "*fructus carnosus,*" similar to that of *P. edulis,* described as being baccate and fleshy like a cucumber, which it resembles in form: this agrees with the fruit of *Spathodea campanulata,* which again offers much analogy in its internal structure with that of *Parmentiera cerifera,* whose fruit is said by Dr. Seemann to be "*epulposa,*"—its seeds, like small lentils, being figured as seated around the greatly enlarged dissepiment, within the small annular space left between it and the pericarpial covering. If, therefore, *Parmentiera* be found to have a bilocular ovary with numerous ovules upon the dissepiment, the genus ought at once to be consigned to the *Bignoniaceæ*; indeed its characters appear wholly at variance with the *Crescentiaceæ.* As its species form upright trees, it probably belongs to the tribe *Catalpeæ,* and will find its place near *Spathodea* (where DeCandolle was originally disposed to fix it), there being a very close approximation in the form and structure of the fruit in *Parmentiera, Spathodea,* and *Stereospermum.* Dr. Seemann considers that the growth of the flowers upon its trunk indicates its affinity with *Crescentia*; but we find the same mode of floral development in *Colea,* and I have occasionally witnessed the same in some species of *Tecoma,* where racemes grow out of the old leafless axils of the stems.

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* Hook. Kew Journ. Bot. ix. 82.

If these exclusions be adopted, the *Crescentiaceæ* would be reduced to three genera, having for their characters an indehiscent fruit and apterous seeds imbedded in pulp, this last being the chief distinguishing feature. These genera are *Crescentia, Kigelia,* and *Schlegelia*; for Dr. Seemann affirms that *Tripinnaria* belongs to *Kigelia.* The structure of the ovary in these genera appears in no way different from that of the *Eccremocarpeæ*; that is to say, it is unilocular, with two opposite longitudinal parietal placentæ; but a distinction is manifested in the subsequent development; so that, in examining the fruit, we must bear in mind the previous structure of the ovary. The want of materials has prevented me from investigating this subject. I have been able to examine only a single ovary of *Crescentia,* which was partly injured by caries; but this satisfied me that it had only two parietal placentæ. *Kigelia* I found similarly constructed, and not bilocular, with ovules borne on the centre of the dissepiment, as is represented in Delessert's 'Icones,' v. tab. 93 B. fig. 3: the appearance there shown is the result of the touching of the opposite projecting placentæ, which, in the younger state of the ovary, and even after the fall of the corolla, I have found separated by a long interval. In *Schlegelia* I have also verified the same structure. In regard to the fruit of *Crescentia,* the details of Gaertner are precise, are illustrated by good figures *, and appear worthy of full confidence: it is circular in its transverse section; its indehiscent shell, though thin in substance, is hard and somewhat ligneous, marked externally and internally by four equidistant longitudinal ridges, the cavity being filled with a soft pulp, in which the seeds are imbedded. The description of Gardner†, in regard to the fruit, is similar; but he gives a very different account of the ovary, which he says is "1-celled, with four fleshy parietal polyspermous placentæ placed one on each half of the pericarpial leaves, and at equal distances from each other." There appears some error in this statement; for it is contradicted in his account of the fruit, which states, "pericarp woody, consisting of two indehiscent carpels placed anterior and posterior to the axis of inflorescence." Of the existence of two opposite placentæ there can be no doubt; the two intervening prominent lines, in the case which I observed, were bare of ovules, and seemed to arise from the line of junction of the thickened sterile margins of the normal carpels, similar to what I observed in the ovaria of *Kigelia* and *Schlegelia*: at first sight these seem to have four lines of placentation; but a more careful observation shows the presence of two only. If this view of the structure of the ovary in the *Crescentiaceæ* be correct, it will be represented as in fig. 16, that is to say, of two carpels placed face to face, which are placentiferous on their midribs and conjoined by their sterile margins, a structure that will be seen to correspond with the *Eccremocarpeæ* (fig. 14), differing only in the greater thickening of the margins of the carpels. It remains to be ascertained whether the pulp of the fruit in these genera results from a secretion formed at the internal surface of the ovary, or whether it arises from the existence of an arillus round each seed: if the latter be the case, as is very probable, it would offer a good discriminating character between the *Crescentiaceæ* and *Bignoniaceæ*; for no trace of any arillus has yet been observed in the latter family; otherwise there is little real distinction between the two orders. The floral characters in all the *Crescentiaceæ* are similar to those of the *Bignoniaceæ*; and there is no essential difference in the structure of their exalbuminous seeds, for it has been shown that the presence or absence of a membranaceous wing no longer offers any line of distinction between the two families. Setting aside the yet uncertain question of an arillus, the claims of the *Crescentiaceæ* to an ordinal rank are feeble, being reduced simply to the presence of pulp and the indehiscence of the fruit. If these claims should be considered of insufficient value, this small group, without inconsistency, might still be retained, after the example of DeCandolle, merely as a tribe of the *Bignoniaceæ*.

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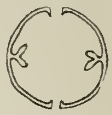
* De Fruct. iii. 230. tab. 223.

† Hook. Journ. Bot. ii. 423.

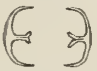
Fig. 16.



The group of the *Cyrtandraceæ* has been considered by many of the most eminent botanists as a tribe of the *Gesneriaceæ*, among whom are Mr. Robert Brown (Pl. Jav. Rar. 105), Prof. Endlicher (Gen. Pl. 716), and Mr. Bentham (Lond. Journ. Bot. v. 360). On the other hand, Prof. Lindley (Introd. 283) and Prof. DeCandolle (Prodr. ix. 258) regard it as a distinct family, more allied to *Bignoniaceæ*. It differs from *Gesneriaceæ* in its perfectly and constantly superior ovary and its exalbuminous seeds: it accords with *Bignoniaceæ* in the form of its calyx and corolla; in its stamens being often didynamous, when frequently only two of them are fertile, as in *Catalpa*; in its anthers being more or less divaricated at their base, and united at their summit by a connective, which forms an apicular excurrent appendage;

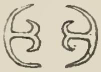
and in its free 2-locular ovary, seated within a fleshy disk. It differs from *Bignoniaceæ* in the species being for the most part herbaceous, with alternate or radical leaves, which are never strictly pinnate; in its prominent bifurcate placentations, which frequently produce the appearance of four cells in the fruit; in its very numerous minute and always pendent seeds, and its terete radicle with very small cotyledons. These characters are sufficient to establish its claim to a distinct ordinal rank. The ovary in *Cyrtandraceæ* appears to be composed of two carpellary leaves, placentiferous on their midribs and conjoined by their sterile margins, as in *Jacaranda* and *Crescentia*; it is consequently unilocular, with two opposite parietal placentæ, which severally bifurcate (fig. 17). By the subsequent growth and approximation of the placentæ, the 2-valved capsular fruit frequently becomes spuriously 2-locular or falsely 4-celled: the generally comose extremities of the seeds bear some analogy to a somewhat similar development in *Sparattosperma* and *Astianthus* among *Bignoniaceæ*.

Fig. 17.



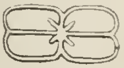
The *Pedaliaceæ* (excluding *Sesameæ* for reasons to be presently stated) correspond in the constitution of their carpels with the *Crescentiaceæ*, and therefore, in some degree, with the *Eccremocarpeæ*. The ovary generally consists of two carpels, placentiferous on their midribs and conjoined by their sterile margins; it is therefore 1-locular, with two opposite parietal prominent placentæ formed of two very recurved lamellar plates, which bear the ovules on their margins (fig. 18): hence the fruit, by the growth and subsequent hardening of the placentæ, becomes pseudo-4-locular. The figure of the ovary and fruit of *Martynia annua* given by Gaertner (de Fruct. tab. 110) affords a very correct idea of this structure, as I had an opportunity of verifying by an examination of the fruit, during its several stages of growth, when on my journey across the Pampas. Taking this example as an exponent of the general structure of this group, it appears to establish its right to à distinct ordinal rank among the Bignonial alliance.

Fig. 18.



The *Sesameæ*, in the structure of their carpels, differ from all the before-mentioned groups, and should therefore be excluded from the Bignonial alliance. Their ovary consists normally of four carpellary leaves, placentiferous (not on their midribs, but) upon their margins, which are inflected and meet in one common axis, where they form a central column surrounded by four cells which lie in parallel pairs (fig. 19); thus conjoined, the capsular fruit becomes 4-celled and 2-valved, the seeds remaining attached to the central column, which separates from the valves. DeCandolle (Prodr. ix. 253) arranged the *Pedalineæ* as a tribe of

Fig. 19.



the *Sesameæ*; but, from the great difference in the normal constitution of their carpels, this union cannot be maintained. Endlicher, on the other hand (Gen. Plant. 709 and 723), places the *Sesameæ* at a considerable distance in the system from *Pedalineæ*, ranking the latter before *Orobanchaceæ*, and considering the former as a suborder of the *Bignoniaceæ*, from which they certainly differ very widely. In many respects the *Sesamaceæ* will be found to approach *Verbenaceæ*: there is a great similarity in the form of their calyx and corolla; but in the one their divisions are five, and in the other four: *Priva*, however, is 5-merous, as in *Sesamum*. *Ceratotheca* has four didynamous stamens, as in *Verbena*; while *Priva* has the rudiment of a fifth stamen, as in *Sesamum*. *Ischnia verbenacea* has flowers like those of *Verbena*, and has the habit of that genus. In *Tamonea* and *Verbena* (*Shuttleworthia*) the anthers are furnished with apicular appendages, as in *Sesamum* and its congeners; and the capsule of *Priva* splits into two halves, each 2-celled, with erect seeds, thus offering much analogy with the fruit of *Sesamaceæ*: the seeds in both cases are exalbuminous, with an embryo of similar form. The capsule, also, is often echinate or cornute in *Priva* and *Tamonea*, as in *Sesamum* and *Ceratotheca*. In habit there is also much accordance between *Priva* and *Sesamum*.

Tourretia has always been considered as a doubtful genus of the *Bignoniaceæ*; but if the structure of the fruit be correctly described, it evidently belongs to *Sesamaceæ*, as Fenzl long since indicated *: it has a 4-celled capsule, which opens only at the apex by a gaping transverse fissure, greatly after the manner of dehiscence in *Sesamum*; and the seeds are affixed to a central axis, as in that genus, and are erect, not transverse as in *Bignoniaceæ*, showing that this structure results from the combination of four carpels, whose placentiferous margins meet in the axis—a structure quite incompatible with *Bignoniaceæ*. In regard to its echinate fruit, the retrorsely uncinate spines that cover its capsule are precisely analogous to those of *Harpagophytum*, which, from its axile placentation, certainly belongs to *Sesamaceæ*, and not to *Pedaliaceæ* (we find a corresponding tendency to the production of spines in the capsules of *Ceratotheca* and *Sporledera*); and its seeds have a similar rugosely expanded border. The principal difference is in the habit of the plant, which, though herbaceous, has conjugate leaves, its leaflets being again palmately divided; and they have an intermediate cirrhus, which is also pinnately branched. *Harpagophytum* and *Sesamum* have tripartite or palmatifid leaves, laciniately divided, but they have no cirrhus. But as *Eccremocarpus* and *Calampelis* are admitted into the *Bignoniaceæ*, and must be associated with *Jacaranda*, many of the species of which form large trees with ecirrhose pinnated leaves, we cannot refuse to admit *Tourretia* into the *Sesameæ* because of the presence of a cirrhus. The seeds of *Tourretia* are alike in shape and position, and have the same kind of cristate margin as in *Sesamopteris*.

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* Fenzl, Denksch. Regensb. iii. 211; A. DeCandolle, Prodr. ix. 236 in adnotat.

In the tribe *Bignonieæ*, the cells of the ovary are anterior and posterior to the axis of inflorescence; but the four lines of placentation stand laterally right and left of the same line of axis. In the *Catalpeæ*, on the contrary, the cells of the ovary are right and left, while the lines of placentation are upon the transverse dissepiment, which has a direction radiating from the axis of inflorescence. In the *Platycarpeæ*, where the ovary is also 2-celled, the placentations being on the dissepiment, the cells as well as the placentæ preserve the same dextral and sinistral aspect. In the *Eccremocarpeæ*, where the ovary is unilocular, the two component carpels and their placentæ stand right and left of the axis of inflorescence. The *Cyrtandraceæ* present precisely the same carpellary characters. In the *Pedaliaceæ*, where the sutural lines of a 2-carpellary ovary are also anterior and posterior, the two bifurcate placentæ, as in *Gesneriaceæ*, have a parietal origin on the right and left of the axis of inflorescence.

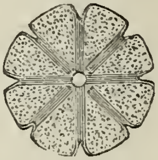
The above character, founded upon the origin of the placentæ upon the midrib of the normal carpellary leaves, is, I believe, universal among all the tribes of the *Bignoniaceæ*, the *Crescentiaceæ*, the *Cyrtandraceæ*, the *Pedaliaceæ*, the *Gesneriaceæ*, and perhaps also the *Orobanchaceæ*, which might all be associated in one general alliance. This is somewhat at variance with the Bignonial alliance of Prof. Lindley, which comprehends also the *Acanthaceæ*, *Scrophulariaceæ*, and *Lentibulariaceæ*, which ought to be rejected—the latter because of its free central placentation, the two former on account of the different nature and position of their carpels. The *Scrophulariaceæ* have a most intimate relationship with the *Solanaceæ*, as I have elsewhere demonstrated; they, as well as the *Atropaceæ*, *Gentianaceæ*, and *Acanthaceæ* (forming a Solanal alliance), are distinguished by an ovary composed normally of two carpellary leaves, which are placentiferous on their margins (not on their midribs), which margins are more or less deeply inflected and conjoined into a dissepiment: the lines of placentation here are antical and postical in regard to the axis of inflorescence, not right and left of it as in the Bignonial alliance.

There is much evidence in favour of the conclusion that, except in the few instances where they form stunted shrubs, the *Eubignonieæ* are climbing plants, and that the *Catalpeæ* invariably form standard trees, or erect shrubs. Most of the former have 3-foliolate leaves, in which very often, and especially in the superior axils, the odd leaflet is transformed into a cirrhus, thus forming cirrhosely conjugated leaves; in rarer instances, the leaves are either simply pinnate or 2–3-pinnate, the leaflets being always petiolulated, and then generally the odd normal foliole is also converted into a cirrhus. Among the *Catalpeæ,* on the contrary, the leaves, with very few exceptions, are either pinnate or quinate; and I am not aware of the existence of a cirrhus in any legitimate species of this tribe; for I have shown that all the conjugate-leaved species of *Tabebuia* must be excluded, not only from that genus, but from the tribe. A great portion of the simple-leaved species of the order have been arranged among the *Eubignonieæ;* but it will be seen that most of them must be removed into the *Catalpeæ.* An exception to this rule might be cited in the genus *Delostoma;* substantial reasons, however, will be given for transferring it into the *Catalpeæ.* I have not seen the fruit of *Astianthus,* nor are any satisfactory characters given of it: the hairy, pappose villosity of its seeds constitutes a feature quite unknown among the *Eubignonieæ,* and the examination of its ovary leads to the belief that it belongs to the *Catalpeæ;* indeed, in the form of its capsule, the hairy covering of its seeds, and its crowded, alternate or almost verticillate, linear, simple leaves, it is probable that *Catalpa longisiliqua* is congeneric with it. I believe the general habit of the plant to be a constant feature, and that for purposes of generic distinction it offers a character equal in importance to that of the structure of the flower or of the fruit and seed. The presence, however, or absence of a cirrhus in a conjugate leaf, which frequently falls off at the point of its articulation with the petiole, or the substitution of a third foliole in the place of a cirrhus, are not indications of much value; for all these three conditions commonly occur in the same plant among *Eubignonieæ;* so that its adoption for a divisional character, as employed by DeCandolle, has been quite useless. The presence of simple and compound leaves in the same species, or even in the same genus, must not be held to be a feature of frequent occurrence, as some botanists have inferred; for I believe such instances to be extremely rare: they occur chiefly among the *Catalpeæ,* and then only in the few cases where the folioles are not petioled, or where the main petiole is winged, that is to say, where the leaf is rather pinnatifid than truly pinnate: in such cases the extent of division of a simple leaf may be varied, even in the same plant, as happens in many other families; but this kind of division is only the modification of the simple serrated leaf. In regard to this rule among *Eubignonieæ,* Chamisso relates that in his *Bignonia pterocarpa* and *B. samydoides,* the leaves in the primary axil only are simple, in the second and third axils they are deeply bifid, but in all the following nodes they are, as usual, 3-foliolate, or cirrhosely conjugated: in the simple leaf just mentioned, its petiole is as long as the petiole and petiolule conjoined of the conjugate leaf, showing that this circumstance arises from its stipuloid character, or is owing solely to the suppression of one of the folioles from imperfect growth, or its decadence in the early weak state of the plant, and is not the complete development; it cannot therefore be adduced as an exception to the ordinary rule.

There are a few species, among *Eubignonieæ*, with heterophyllous leaves, that offer an exception to the general rule; these, however, are not properly climbers, but are of an erect and short stature; *Bignonia brachypoda*, DC., represents the type, and among them may be classed three plants hitherto placed in *Cuspidaria*. Most of the instances I have seen of these truly heterophyllous species are generically alike, and they constitute a group that may be regarded as a subgenus of *Arrabidea*. By this isolation, and with this exception, we maintain a constancy in the rule of foliaceous development that I have advocated. In the group just mentioned we meet with heteromorphous varieties, where, in consequence of some morphological change in a few of their many 3-foliolate leaves, two or all three leaflets grow together, assuming the state of a single leaf, or of an unequal pair of conjugate leaves of an unusual gibbous form: the mode of distribution of the nerves in such cases shows that such coalescence is due to the same kind of monstrous growth which, under similar exceptional circumstances, we see in other families. As it sometimes happens that the cirrhus is wanting, it may be urged that one of the folioles of a conjugate leaf may also be suppressed, and the other reduced to the state of a simple leaf: of the possibility of this occurrence there can be no doubt; but observation shows that such instances are extremely rare, and then not universal in the same plant, and must be held to be entirely of an exceptional character. Under the genus *Panterpa*, of which *B. leucopogon*, Cham., is the type, I have explained how, and under what circumstances, simple and compound leaves occasionally occur in the same plant; but it is there shown that the simple leaves in such cases partake of a stipuloid nature. These instances therefore cannot be said to affect the general rule above indicated.

There is sometimes a peculiarity in the ligneous structure of the *Bignoniaceæ* that merits attention: the stems of many of them, in their transverse section, exhibit strong medullary rays, not radiating from one common central point, as generally occurs, but disposed in parallel decussating plates, in the form of a cross,

Fig. 20.



as shown by Plumier in *Bignonia crucigera* (Pl. Am. Burm. tab. 78. fig. A), and by Gaudichaud in *Bignonia capreolata, B. unguis, B. lactiflora,* &c. (Rech. Org. Vég. tab. 14. fig. 4; tab. 18. figs. 4, 5, 6, 7, 8, 9 & 10). The latter botanist remarks that this peculiarity is more strongly developed in the plants of equatorial regions: he adds that only four cruciform rays are at first seen; subsequently these are increased to eight, then to sixteen, thirty-two, &c., and always in this geometrical progression. I possess the stem of a Bignoniaceous climber from the region of the Organ Mountains; it is deprived of its bark, and is about an inch in diameter: here four principal rays are prominently developed, with four other intermediate rays less strongly marked (fig. 20); and corresponding with these rays, the stem has eight deep, longitudinal, broadly gaping fissures, that run through its entire length and extend half-way towards the centre. In these fissures, at intervals of every 4 or 5 inches apart, are seen the sprouts branching from the centre, out of which the decussating opposite leaves have originated; and it is to be remarked that these leaf-sprouts are always found in the four alternate grooves which correspond with the secondary set of medullary rays above mentioned. Each of these axillary sprouts is formed of a congeries of four sets of concentric plates united together in one common bundle—a structure probably connected with the development of conjugate leaves. The wood is extremely light and porous, and I believe it to be the stem of *Bignonia Rego*, Vell., the *Arrabidea Rego*, DC. (misspelt *Sego* in the 'Prodromus')*. I have not seen any specimen of this plant, and have some doubt whether it be a true species of *Arrabidea*; at all events, it must not be taken as the type of the genus, though placed first on its list in the 'Prodromus' by DeCandolle, who appears to have known it only from Velloz's drawing.

In the 'Prodromus' of DeCandolle too much importance has been assigned to the form of the calyx as a generic feature of distinction: on the one hand, this distinction has been little attended to in the selection of the species under the different genera, as in *Cuspidaria, Arrabidea, Tabebuia,* &c.; while, on the other hand, many species, generically distinct, are brought together in one group, as in *Spathodea, Tabebuia,* &c. It will be seen, in the descriptions I here propose to give of sundry Bignoniaceous plants, that in the same genus the size, shape, marginal dentations or fissures of the calyx vary to a considerable extent, and that the great peculiarity of form, which was thought to characterize only the genus *Spathodea,* exists also in the genera *Macfadyena, Mansoa, Dolichandra, Tabebuia,* and some others. The same may be said of *Cuspidaria,* where but few of the species enumerated by DeCandolle possess the long cuspidate teeth that suggested this generic name, while similar long setaceous teeth are found in *Mansoa, Tynanthus,* and several other genera. I have placed the *Bignonia glutinosa*, DC., and other kindred species, in a genus near *Dolichandra,* notwithstanding that its calyx (as also its corolla) becomes nearly as much enlarged and coloured as in *Callichlamys;* but this feature is only due to the extreme increment of those parts, which may be traced in all its various gradations.

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* This error has originated in copying the name from the lithographed plate of the 'Flora Fluminensis,' executed in Paris, in which work numerous similar misnomers occur. Had DeCandolle referred to the text of that work, he would have discovered the mistake, and have called the plant *Arrabidea Rego*: the latter is a Portuguese word signifying a rent or fissure, in allusion to the fissures I have described, and which are represented in the plate referred to, vol. vi. tab. 39.

One of the most important features that serve to mark the genera of the *Bignoniaceæ* exists in the form and development of the fruit; but unfortunately this is rarely available, as few cabinet specimens present this test; indeed, in some genera the fruit is quite unknown, and I am glad to be able to supply this desideratum in several cases.

The anther-lobes, in most instances, are divaricated to their utmost extent, when, from the mutual incurvature of the filaments, the lobes stand in a vertical position and at right angles with the filaments; the two lobes of each pair are thus brought into juxtaposition, as in the *Gesneraceæ*: sometimes, as in *Tynanthus,* the anther-lobes, fixed at right angles upon the apex of the filaments, are suddenly curved upwards. In several instances the filaments are nearly straight, and the anther-lobes, although free in their whole length, are parallel and pendent from the summit of the filament; this occurs in the genera *Pyrostegia, Dolichandra, Cybistax, Salpingophora, Astianthus; Calosanthes, Millingtonia, Catophractes,* and *Rhigozum,* and is a constant and valid generic character. In some few genera the anther-lobes are sagittately divergent. The glandular summit of the filament (connective), to which the anther-lobes are attached by their apex, is often excurrent and mucronate, sometimes extended into one or two membranaceous appendages, and at other times pilose; but these expansions are not always constant in the same group, and I have not considered their deficiency to be of any generic value. The anther-lobes, as a general rule, are glabrous, but in some instances they are ciliolate or pilose in the same group where others are glabrous; this feature, therefore, cannot be held to be of sufficient importance for purposes of generic distinction. An exception to this rule has been maintained in the extensive genus *Lundia,* which may always be recognized from all others by its densely pilose anthers; but this, notwithstanding, is an artificial character; for by its adoption we find a considerable deviation from one common form in the calyx, corolla, and stamens in several species which, but for this character, would be referable to other genera.

The anther-lobes are fleshy on the dorsal face, and formed in front of a very delicate membrane, where they open by a longitudinal suture, the two margins of which are greatly thickened. In cabinet specimens these margins often separate from the decaying membrane, and stand out like aristæ, for which they have been mistaken by some botanists.

There are several other points of structure in the *Bignoniaceæ* which merit attention; but enough has been said for the purpose here intended, of calling the attention of botanists to the study of this interesting family. I will now therefore proceed to particularize some of the features hitherto unnoticed or insufficiently explained in *Adenocalymna, Anemopægma, Dolichandra, Macfadyena,* and several other genera, notifying at the same time many new species collected by me. I have also brought together, in several new groups, a great number of species that have either fallen under my observation, or that (not having been seen by me) are recognizable from the ample descriptions of authors; they are scattered amongst the genera *Bignonia, Spathodea, Tabebuia, Tecoma,* &c. In the descriptions that follow, which are confined almost entirely to plants of the New World, I have endeavoured to detail the specific characters as laconically as possible compatible with the object in view, and to expose more amply the features that distinguish each genus or each peculiar group; for to the want of such details we must attribute the confusion now existing throughout the family.

In this early stage of the investigation, I have not attempted any arrangement of the genera; and though I recommend the system of distribution adopted by the illustrious DeCandolle, I have not thought it necessary to follow it here. The remarks now offered must be considered, as they are intended to be, rambling contributions of observed facts towards a better knowledge of the family; they are given as mere examples of the groups proposed, and are confined either to the plants of my own collection, which have enabled me to study their characters more fully, or to a portion of those, more especially typical specimens, in the herbarium of the British Museum, and to a very few in the rich and extensive Hookerian collection at

Kew. There still remains a large amount of new plants to be described, or of known species to be better characterized. These I leave to abler hands, hoping to see the task elaborated by some careful botanist, who, after long and cautious study, may be enabled to schedule the species into sections by subdivisions, so as to avoid the necessity for frequent repetition of many essential features in the specific characters (now unavoidable), and thus render the determination of specimens more easy to the student.

ADENOCALYMNA.

This genus was first proposed by Prof. Von Martius, for a group of climbing plants, mostly from intertropical Brazil, which are distinguished by the presence of peculiar greenish glands, almost constantly upon the calyx, and more rarely upon the corolla, whence its generic name. Its branching stems are generally rugose, and spotted all over with hollow lenticels, and often pitted at the nodes with crowded porous dots. The opposite leaves are 3-foliolate when the terminal leaflet is somewhat larger, or they are conjugate with an intermediate cirrhus, both conditions often existing in the same plant. The inflorescence is either axillary in short racemes, or it is terminal, when sometimes, by the abortion of the superior axillary leaves, it forms a pyramidal or elongated panicle. At the axils, within the base of each petiole, there is constantly seen a pair of simple stipuloid leaflets, generally reduced to the size of bracts, which are furnished with glands similar to those of the calyx. The flowers are large and showy, covered with velvety down, and are of a dull-yellow colour, or sometimes purple. The fruit has been hitherto unknown; but I was fortunate enough to find it: it is very different from that of any other Bignoniaceous genus, both in its form and the structure of its seeds. The capsule in the two species I met with is quite cylindrical, about 6 inches long, and $1\frac{1}{2}$ inch in diameter, formed of two thick coriaceous valves, which split open along the edges of the flat dissepiment, as in all *Eubignonieæ*. The seeds, so remarkable in their form and structure, have been described in a preceding page (p. 45).

I have not seen any of the plants referred by DeCandolle to his genus *Pachyptera*, with the floral structure of which he was unacquainted; the genus was established merely on the peculiar development of the seed, the expanded margins of which are thick and coriaceous, like the central discoid portion. This structure, among the *Monostictides*, occurs only, perhaps, in *Adenocalymna*, the seed of which was not then known; so that there is some probability that the two genera are identical. This opinion is confirmed by some of the specific characters given in the 'Prodromus,'—for instance, in the punctate hollows mentioned in the axillary nodes of his *P. foveolata,* which exist in many species of *Adenocalymna,* and which I have not observed in any other genus. DeCandolle, however, describes the capsule as being somewhat flatly compressed and smooth: the flattening of the valves in the dried specimens may probably arise from their warping in desiccation, as I have observed in those of *Adenocalymna;* and the tubercular rugosities, as described in my plants, may be only a specific character; but it is impossible to determine these points without comparative examination. *Adenocalymna* must be placed in the division *Monostictides* of DeCandolle, not among the *Pleiostictides,* where he arranged it.

The following is an emended diagnosis of the genus:—

ADENOCALYMNA, Mart.—*Calyx* tubuloso-campanulatus, coriaceus, sæpius 5-dentatus, rarius fissus, versus apicem glandulis grossis disciformibus viridibus semi-immersis instructus. *Corolla* tubulosa, imo coarctata, hinc inde subcampanulata, extus sæpius pulverulento-velutina, limbo 5-lobo, lobis subæqualibus, rotundatis, quorum 3 erectioribus. *Stamina* 4, didynama, inclusa, cum 5to sterili inter 2 breviora; *filamenta* filiformia, glabra, apice incurva; *antheræ* per paria conniventes, singulæ 2-lobæ, lobis oblongis, apice affixis, segregatis et divaricatissimis, flexione filamentorum axi parallelis. *Ovarium* oblongum, rugulosum, 2-loculare, pluriovulatum, *disco* pulvinato suffultum: *stylus* filiformis, glaber, longitudine staminum: *stigma* bilamellatum. *Capsula* cylindrica, botuliformis, sæpe tuberculis elevatis poriferis subserialibus rugosa, 2-locularis, 2-valvis, *valvis* coriaceis dissepimento crasso parallelis, *replo* bipartibili utrinque subtenui a valvis solubili. *Semina* plura, in utroque margine dissepimenti 1-seriata, transversa, magna, crassa, aptera, crebre coarctata, vix imbricata, compresse suborbicularia, dorso convexiuscula, ventre subangulata, *hilo* pergrandi ovali versus basin notata: *testa* dura, crustacea, nitida, longitudinaliter 2-locularis, *septo* integro coriaceo foramine centrali pro radiculæ receptione fenestrato: *integumentum internum* conforme: *embryo* exalbuminosus, testa configuratus, *lobis cotyledonaribus* 4, crassis, carnosis, plano-convexis, per paria adpressis et in locellis integumentorum nidulantibus, *radicula* perparva, tereti, loborum quarta parte longitudinis, centro inter eos prorsum adnata, et in foramine septi recondita, oblique et horizontaliter centrifuga.

Frutices *scandentes Americæ meridionalis intertropicæ, plerumque*

Brasiliæ; rami *poroso-rugosi:* folia *opposita, nunc* 3-*foliolata, foliolo mediano longius petiolulato, nunc cirrhoso-conjugata,* cirrho *simplici:* foliola stipuloidea *sub-bracteiformia ad basin ramulorum novellorum utrinque bina glandulifera:* racemi *axillares, terminalesve, sæpius pulverulento-velutini,* flores *breviter pedicellati,* pedicelli *bracteis glanduliferis donati;* corollæ *flavæ, aurantiacæ, vel purpureæ.*

Species novæ, aliæque plantæ cognitæ, nunc ad hoc genus relatæ:

1. *Adenocalymna scansile,* n. sp.;—ramis glaberrimis, striatis, pallidis, teretibus, lenticellis porosis præsertim circa axillas subnodosas ruguloso-punctatis: foliis conjugatis, cum cirrho sublaterali simplici cito deciduo; foliolis oblongis, imo cordatis, inæquilateris, hinc gradatim acutis, apice mucronatis, pallidis, superne lævissimis, opacis, nervis immersis, inferne nervis venisque tenuiter reticulatis prominulis, nervo marginali pellucido, glabris, granulis porosis punctatis, rachi subtus prominente cum petiolo petiolulisque puberulis; foliolis stipuloideis bracteiformibus, intrapetiolaribus, linearibus, acutis, rigidis, concavis, extus glandulis immersis signatis: racemo terminali, folio sub-breviore: capsula botelloidea, tuberculis majusculis in lineis nunc interruptis notata, seminibus magnis pallide brunneis.—Brasilia in Prov. Rio de Janeiro, *v. s.*

Ab *A. marginato,* DC., differt foliolis cordatis, et pro ratione latioribus. Internodia 5 poll. remota; petiolus 6 lin., petioluli 3 lin. long.; foliola 3 poll. long., 1–1½ poll. lat.; foliola stipuloidea 3 lin. long., 1 lin. lat.; racemus fructifer rachi incrassata 2 poll. long., 2 lin. crassa; flores ignoti; capsula pallida, 4½ poll. long., 1½ poll. diam.; valvæ crasso-coriaceæ; semina in 2 loculis circiter 50, creberrime congesta, utrinque ad margines dissepimenti uniserialia, exalata, crassa, crustacea, 9 lin. diam., hilo magno 8 lin. long. et 3 lin. lat.

2. *Adenocalymna prehensile,* n. sp.;—ramis subteretibus, striatellis, ad nodos dilatatis, lenticellis porosis inconspicuis rugulosis; foliis conjugatis, cirrhosis, omnino glaberrimis; foliolis oblongo-lanceolatis, imo subobtusis, 5-nerviis, inæquilateris, hinc gradatim attenuatis, apice mucronatis, coriaceis, utrinque reticulato-venosis et ruguloso-punctatis, supra pallide viridibus, nitidis, subtus opacis, pallidioribus, nervis venisque prominentibus, margine cartilagineo pellucido; petiolulis petiolo paulo brevioribus, omnibus transversim corrugato-rugosis, teretibus, apice tumidulis; foliolis stipuloideis linearibus, bracteiformibus, glanduliferis; racemis axillaribus folio brevioribus, rachi in fructu valde incrassata, apice ampliata;

capsula subcylindrica, tuberculis majusculis elevatis seriatis interdum in lineis interruptis confluentibus.—In montibus circa Tejuco, Prov. Rio de Janeiro, *v. v.*

Species distincta: internodia 2½–4½ poll. remota; rami ad nodos linea transversali signati; folia in articulationibus sæpe luxata; petiolus 9–12 lin., petioluli 6–7 lin., cirrhus simplex 6 poll. long.; foliola 5 poll. long., 16 lin. lat., mucrone apicali calloso glandulifero; foliola stipuloidea iis præcedentis similia; racemus fructifer 2 poll. long., pedunculus 3 lin. crassus, apice ad 5 lin. diam., ampliatus; capsula botelliformis, 6 poll. long., 1½ poll. diam.; semina iis speciei prioris similia *.

3. *Adenocalymna flavidum*, n. sp.;—ramis flavescentibus, striatis, lenticellis parvis porosis angulosis, patentim hirsutulis, nodis remotis tumidulis; foliis conjugatis, cirrhosis, cirrho cito caduco, superioribus minoribus et sæpe 3-foliolatis, foliolis oblongis, imo subæqualibus, subrotundis, hinc gradatim acutis, apice callosis, supra lævibus, planis, opacis, pallide viridibus, minute reticulatis, subtus petiolisque flavido-pilosis, hinc nervis venisque reticulatis prominulis, margine cartilagineo, reflexo, petiolo petiolulisque subæqualibus rugulosis et angulato-striatis; racemis axillaribus, brevibus, petiolo paulo longioribus, e foliolis stipuloideis binis linearibus intrapetiolaribus glanduliferis enatis; floribus congestis, cano-velutinis, flavis, calyce 5-dentato, piloso, glandulis majusculis glabris fusco-viridibus concavis signato.—In montibus circa Tejuco, Prov. Rio de Janeiro, *v. v.*

Species insigniter ab *A. bracteato*, DC., diversa, e cirrho sæpius caduco, foliolis majoribus, flavido-pilosis, racemis axillaribus multo brevioribus et paucifloris, calyce minore dense flavo-tomentoso glandulis majusculis viridibus irregulariter 2-seriatis, et corollæ tubo magis cylindraceo. Rami valde tomentosi, ad nodos tumiduli et hinc poroso-punctati. Internodia 7 poll. dist., superiora breviora 3–4 poll. remota. Folia inferiora majuscula, petiolus 7 lin., petioluli 9 lin. long., foliola 5–6 poll. long., 2–2½ poll. lat., superiorum petiolus 7 lin., petioluli 5 lin., cirrhus 5 poll. long., foliola 2½–3¼ poll. long., 1–1¼ poll. lat.; foliola stipuloidea linearia, interpetiolaria, rigida, erecta, glandulifera, 4 lin. long., 1 lin. lat.; racemi flavido-velutini; pedunculus 1 poll. long., circiter 8-florus, pedicelli oppositi, 2 lin. long., bracteæ velutinæ, lineares, acutæ, 3 lin. long.; calyx tubulosus, late et breviter 5-dentatus, 4 lin. long., 2½ lin. diam.; corollæ flavæ tubus late cylindricus, imo repente angustatus, 1¾ poll. long., ore 5 lin. diam. (constrictione basali 8 lin. long., 1 lin. diam.); limbi lacinia 5, oblonga, obtusa, inæqualia, 4–6 lin. long., 2–3 lin. lat.; filamenta 2 antica breviora; antheræ inclusæ.

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* A drawing of this species, with details of its fruit and seeds, are given in Plate 53.

4. *Adenocalymna lanceolatum*, n. sp.;—glaberrimum, ramulis teretibus vix striatis, lenticellis porosis sparsis punctatis, strictis, nodis remotis, compressis et dilatatis; foliis 3-foliolatis, aut terminali caduco conjugatis, foliolis oblongo-lanceolatis, ab imo obtuso gradatim acutis, terminali ad basin subacuto, apice longe mucronatis, supra nitidis, subtus pallidioribus, nervis tenuibus venisque delicatulis reticulatis vix prominulis, petiolulo mediano petiolo æquilongo, et lateralibus duplo longiore, vel interdum quasi in cirrhum apice foliiferum longius producto, omnibus apice tumidulis; foliolis stipuloideis intrapetiolaribus, lanceolato-linearibus, concavis, extus glandulosis; racemis axillaribus, folio tertia parte brevioribus, pedicellis medio bracteis 2 linearibus parvis donatis; calyce tomentoso, 5-dentato, 2-seriatim glandulifero; corolla flava, glandulis plurimis viridibus in lineis 5 dispositis notata.—Rio de Janeiro, *v. v.*

Species valde perspicua. Internodia 4½–5 poll. remota; ramuli quasi virgati, axillis nodosis dilatatis utrinque linea transversa elevata notatis; petiolus 6–9 lin., petiolulus medius 8 lin., interdum 2½ poll. et quasi cirrhiformis apice foliolifero, laterales 4 lin. long.; foliola lateralia 3–4½ poll. long., 14–16 lin. lat., intermedium paulo longius et latius, omnia subtus nervis divaricatis prominulis sub lente puberula; foliola stipuloidea sub-bracteiformia, rigida, erecta, glandulifera, 3 lin. long.; racemi axillares, 2 poll. long.; flores circiter 24, pedicelli oppositi, 2 lin. long.; bracteæ filiformes, cito caducæ, 1 lin. long.; calyx 4 lin. long., 2½ lin. diam.; corolla pollicaris et ultra, in alabastro 7 lin. longa.

5. *Adenocalymna divaricatum*, n. sp.;—glaberrimum, ramulis fusco-rubris, teretibus, striatis, lenticellis parvis albidis punctatis, ad axillas nodosis et dilatatis; foliis conjugatis, patentibus, cirrho simplici, petiolulis petiolo brevioribus, foliolis ellipticis, fere æquilateris, imo subobtusis, e medio longe acuminatis, apice mucronatis, subcoriaceis, utrinque nitidis, glaberrimis, nervis venisque valde reticulatis rufulis prominulis, subtus flavido-pallidioribus; foliolis stipuloideis intrapetiolaribus, linearibus, acutis, divergentibus, glanduliferis; racemis axillaribus, pedunculo glabro, rufo, petiolo 3-plo longiore; floribus speciosis, circiter 12; pedicellis oppositis, medio 2-bracteatis; calyce extus fusco-velutino, fere integro,

mucronibus 5 denticulato, glandulis concavis plurimis 3-serialibus immersis notato; corolla flava, longe infundibuliformi-campanulata, pulverulento-velutina.—Ad montem Corcovado, Rio de Janeiro, *v. v.*

Species evidenter *A. Salzmanni* proxima, sed differt foliis valde divaricatis, foliolis longe acuminatis, et nervis rufescentibus. Internodia 3½–4 poll. remota; foliola 3–3¾ poll. long., 1½–1¾ poll. lat.; petiolus superne sulcatus, ¾–1 poll., petioluli 5–6 lin. long., omnes striati et divaricati; cirrhus simplex, 4 poll. long.; foliola stipuloidea 2 lin. long.; racemi pedunculus divaricatus, 2 poll. long.; pedicelli oppositi, basi bracteola unica, medio duabus muniti (hinc normaliter 3-flori, abortu 1-flori), cunctis linearibus, glanduliferis, 1½ lin. long., caducissimis; calyx fusco-velutinus, glandulis porosis 2-seriatis infra dentes signatus, 4 lin. long.; corollæ tubus basi coarctatus, 1½ poll. long., limbi ampliati lobi late obrotundi, ¾ poll. long., quorum 3 erectiores; stamina tubo dimidio breviora; antherarum loculi lineares, omnino segregati, divaricatissimi, e filamentis incurvis hinc verticaliter positi et per paria approximati, connectivo apice excurrente; ovarium oblongum, 4-carinatum, disco pulvinato suffultum; stylus filiformis, elongatus.

6. *Adenocalymna bracteatum*, DC. Prodr. ix. 200;—Bignonia bracteata, *Cham. Linn.* vii. 692.—Rio de Janeiro, *v. v.*

Species *A. flavido* proxima; rami ad nodos compressi et dilatati, lenticellis parvis rugosi, molliter puberuli; folia inferiora 3-foliolata, superiora conjugata et cirrhifera; foliola supra nitida, subtus molliter pilosa, 3–3½ poll. long., 14–18 lin. lat.; petiolus striatus, lenticellis rugosus, sub 1-pollicaris, petioluli laterales 4 lin., medius 7–9 lin. long., cunctis puberulis; folia stipuloidea intra petiolum linearia, glandulis immersis notata, 2 lin. long.; racemi pedunculus 3½ poll. long.; pedicelli tomentosi 3 lin. long., imo bractea singula medio binis tomentosis 3 lin. long. donati, hinc abortione 1-flori; calyx coriaceus, tubulosus, velutinus, 5-carinatus, breviter 5-dentatus, sub-5-gonus, summo glandulis inconspicuis 3-serialibus immersis signatus, 5 lin. long.; corolla campanulata, extus tomentosa; ovarium oblongum, glabrum, glandulis favosis rugosum.

7. *Adenocalymna nitidum*, Mart., DC. Prodr. ix. 200.—Ad montem Corcovado, Rio de Janeiro, *v. v.*

Species, ut bene dixit cl. DeCandolle (loc. cit.), cum nonnullis aliis confusa: certe a *Bignonia unguiculata*, Flor. Flum. vi. tab. 33, valde diversa, ut posterius demonstretur; *Cuspidaria pauciflora* DC. identicam credit cl. Sonder (Linn. xxii. 560), sed clare diversissima. Ad diagnosin in Prodr. cit. annotabitur:—rami teretes, nitidi, lenticellati, ad nodos compressi et dilatati, hinc linea elevata transversali notati; internodia 3½–4½ poll. dist.; folia glaberrima, inferiora 3-foliolata, superiora cirrhoso-conjugata, foliola crasso-coriacea, utrinque pallida, supra nitida, subtus opaca et poroso-punctata, inferiora 4 poll. long., 2 poll. lat., petiolo patentissimo, angulato, rugoso, 1¾ poll., petiolulo med. 1 poll., lateral. 5 lin. long.; foliola superiora 2½–3 poll. long., 1–1½ poll. lat., petiolo 9 lin., petiolulis 4 lin. long.; cirrhus simplex, 2¾ poll. long.; foliola stipuloidea prioris, 3 lin. long.; racemi axillares et terminales, nutantes, inter foliola stipuloidea enati, 3–4 poll. long., circiter 24-flori; pedunculi oppositi, abortione 1-flori, 3 lin. long., bracteis 1 basali foliacea glandulifera 5 lin. long., binis in medio caducis muniti; calyx 5 lin. long., fere integer, e nervis excurrentibus 5-denticulatus, tomentosus, glandulis viridibus circa 10 infra dentes signatus; corolla flava, velutina, late infundibuliformis, tubo 1½ poll. long., limbi lobis 5 rotundis, 6 lin. long. et lat.

8. *Adenocalymna stridula*;—Bignonia Kerere, *Aubl. Pl. Guian.* ii. 644. tab. 260 (non *Lindl.*); *DC. loc. cit.* 154;—B. heterophylla, *Willd. Sp. Plant.* iii. 298;—ramulis gracilibus, glabriusculis, angulato-striatis, ad nodos compressis et dilatatis, et hinc utrinque punctis favosis crebris notatis; foliis inferioribus 3-foliolatis, superioribus conjugatis, cum cirrho simplici; foliolis oblongis, basi ovatis et subcordatis, apice acuminatis, glaberrimis, firmulis, supra lucidis, subtus nervis venisque prominentibus, petiolo favoso-punctato, basi apiceque incrassato, petiolulis summo tumidulis duplo longiore; racemis brevissimis, axillaribus, paucifloris; calyce urceolato, imo coriaceo, glandulis disciformibus sub ore truncatum 5-denticulatum immersis; corolla ampla, lutea, infundibuliformi-campanulata, tubo curvulo, limbo 5-lobo, sub-bilabiato, lobis 2 superioribus erectioribus, paulo majoribus, genitalibus inclusis; capsula lanceolato-ovata, subcompressa, coriacea, glanduloso-rugosa.—Guiana Gallica, *v. s. in herb. Mus. Brit.*

Ad *Adenocalymna brachybotryn*, DC., et *A. lanceolatum*, nob., proxime accedit; differt tamen a priore foliis basi non acutis, nervo mediano striato et prominente, sed non acute carinato, racemis axillaribus brevissimis, paucifloris, nec terminalibus et multifloris, glandulis calycinis majoribus et paucioribus. Nomen *Kerere* vel *Terere* inter Indos usitatum, *stridulans* significat, quia rami, quum flectantur, sonum crepitantem emittunt: hoc vocamen barbarum ab incolis pariter datum est ad plantas Aubletianas *B. Kerere*, *B. incarnatam*, et *B. echinatam*, qua ratione hæc species Latine *stridula* melius dicitur. Diagnosis in Prodr. DC.

ad plantam cultam Lindleyanam refert, quare palam specim. typic. citat. char. hic reformavi. Internodia 3½–4½ poll. dist.; in axillis superioribus floriferis petiolus 6 lin. long., petioluli 4 lin. long., cirrhus 5 poll. long., foliola 3 poll. long., 15–17 lin. lat. Foliorum inferiorum petiolus 14 lin. long., petioluli laterales 4 lin., terminalis 12 lin. long.; foliola 5½ poll. long., 2 poll. lat.; racemi rachis 6–12 lin. long., 3–6-flora, pedicelli imo breviter bracteolati 3 lin. long.; calyx 4 lin. long.; corolla (in specim. deficiens) sec. Aubl. flava, tubus 2 poll. long., limbi lobi rotundati 6 lin. diam. Ovarium adauctum vidi, 12 lin. long., 4 lin. lat., oblongum, compressum, fuscum, glabrum, glandulis carnosis porosis crebris notatum. Capsula oblonga, compresso-teres, poroso-rugosa, valvis dissepimento plano parallelis coriaceis deciduis; sec. Aubl. (icon. 263) 3 poll. long., 15 lin. lat., et 9 lin. diam. transverso; sec. Splitzb. 3 poll. long., 8 lin. solummodo lata; tunc forma propior capsulæ *Adenocalymnatis scansilis* nuper descriptæ. Semina, sec. icon. cit., utrinque 1-serialia, compressa, margine angusto cincta, 8 lin. long., 11 lin. lat.

9. *Adenocalymna verruciferum*; — Bignonia verrucifera, *Schl. Linn.* xxvi. 655;—ramulis glabris, lenticellis crebris porosis verrucosis; foliis cirrhoso-conjugatis, foliolis late vel ovato-ellipticis, basi obtusis, subcordatis, sub-3-nerviis, apice acutiusculis, subcoriaceis, supra glabris, nitidis, subtus pallidioribus, opacis, nervis venisque prominulis et obsolete puberibus: inflorescentia e racemulis in ramulis novellis terminalibus, 1–3-floris, lenticellis instructis et puberulis, axillis approximatis, hinc pseudo-corymbosa; calyce campanulato, tuberculis irregulariter verrucoso, margine breviter 5-dentato et mucronato; corolla purpurea, infundibuliformi, glabra, limbo irregulariter 5-lobo.—Columbia ad Curucati (Wagener, no. 307).

Species mihi invisa, sec. cl. Schlecht. ad *Bignoniam glabratam*, H. B. K. accedens; ad altit. 30 ped. scandens; foliola 4–6 poll. long., 2½ usque fere 4 poll. lat.; petiolus 1 poll., petioluli 6 lin. long., supra canaliculati; calyx 3 lin. long.; corolla 1½ poll. long. (parte constricta basali 2 lin. long.), superne elongato-campanulata.

10. *Adenocalymna paniculatum*, Bth. MSS., n. sp.;—ramis glabris, foliis 3-foliolatis, foliolis obovatis, lateralibus, imo subinæquilateris, rotundatis, impari majore, longius petiolulato, basi obtuso, 5-nerviis, apice attenuato-acuminatis, mucronatis, glaberrimis, supra nitentibus, reticulato-venosis, subtus pallidis, nervis tenuibus in axillis barbatis, et sæpe glanduliferis; panicula terminali pyramidali, e basi longe ramosa, ramis oppositis, 3-chotome divisis, multifloris; calyce turbinato,

fulvo-velutino, 5-denticulato, infra marginem glandulis paucis immersis signato; corolla infundibuliformi-campanulata, extus velutina.—Prov. Para, *v. s. in herb. meo* (ad cataractas fluv. Aripecurù, Spruce).

Planta facies *Arrabideæ*, sed propter folia, calycem, corollamque glandulifera ad *Adenocalymnam* referenda: species *A. divaricato* proxima: rami fusculi, striatelli, teretes, ad nodos compressi et dilatati; internodia 3–4 poll. dist.; foliola lateralia 4 poll. long., 2 poll. lat., terminale 4½ poll. long., 2½ poll. lat.; glandulæ immersæ crebræ in axillis nervorum pellucidæ; petiolus 2 poll. long.; petioluli laterales 5 lin., terminalis 9 lin. long., striati et canaliculati; foliola stipuloidea caduca, loco insertionis cicatriculis notata; panicula 12 poll. long. et ultra, ramis basalibus subdivaricatis 7 poll. long., aliis superioribus oppositis gradatim brevioribus; ramulis secundariis 6 lin. long., sensim brevioribus; pedicelli velutini, 2 lin. long.; bracteæ setaceæ, 2 lin. long., divaricatæ; calyx 2–2½ lin. long., glandulis 10 immersis parvis signatus; corolla (sicca) flavida, velutina, tubo 9 lin. long., intra calycem coarctato, lobis 5 inæqualibus, quorum 3 superioribus erectioribus, tenuiter membranaceis, 6 lin. long., 4 lin. lat., 2 inferioribus reflexis, minoribus, crassioribus; stamina longiora faucem fere attingentia; antheræ divaricatissimæ; ovarium cylindricum, lepidotum, tenuiter 4-sulcatum, disco majusculo carnoso pulvinato insitum.

11. *Adenocalymna alliaceum*;—Bignonia alliacea, *Lam. Dict.* i. 421; *Swartz, Fl. Ind. Occid.* ii. 1039; *Aubl. Pl. Guian.* ii. 659; *DC. l. c.* 148; *Splitzb. Pl. Surin.* p. 1;—glaberrimum, ramulis teretibus aut subangulosis, late ellipticis, utrinque acutis, subcoriaceis, supra pallide viridibus, nitidis, nervis immersis, subtus pallidioribus, nervis venisque transversis prominulis, minutissime favoso-punctatis, margine reflexo, petiolulis petiolo brevi subæquilongis aut longioribus, apice basique tumidulis; paniculis axillaribus aut terminalibus, folio multo brevioribus, 5–6-floris; calyce truncato, integro, subtomentoso; corolla majuscula, infundibuliformi-campanulata, glabra, alba, limbi ampliati lobis subæqualibus, oblongis, rotundatis; capsula fere cylindrica, obtusa, oblonga; seminibus suborbicularibus, compressis, marginibus subalatis, coriaceis.—Cayenne et Peruvia, *v. s. in herb. Mus. Brit.* (Cayenne, Aublet); *in herb. meo* (Tarapota, Spruce, 4475).

Planta alte scandens, quæ de longinquo odorem alliaceum spirat: internodia 6 poll. dist.; ramuli infra nodos, ut in plerisque speciebus, crebriter favoso-punctati; foliola 7–8 poll. long., 3–3½ poll. lat.; petiolus petiolulique crassiusculi, 6 lin. long.; paniculæ rachis ½–2 poll. long., ramique 3-chotomi aut 3-flori, valde compressi; calyx coriaceus, enervius, infra marginem integrum glandulis omnino immersis et hac causa facile prætermissis notatus, 3 lin. long.; corollæ tubus ultra calycem coarctatus, 2–2½ poll. long.; limbi lobi 8 lin. long., imo 6 lin., medio 9 lin. lat.; filamenta glabra, per paria incurva, longiora vix ultra medium tubi pertingentia; stylus filiformis, staminibus longior; ovarium oblongum; ovula ad extremos margines dissepimenti utrinque uniseriata. Capsula sec. cl. Splitzb. fere cylindrica, 2½–3 poll. long., 1 poll. diam. aut paulo latior; valvis crassis, lignosis, extus fulvo-tomentosis, dissepimento coriaceo parallelis; semina angulato-orbicularia, marginibus subcoriaceis; conditiones, quæ cum illis *Aden. prehensilis* supra descriptis, omnino congruunt.

12. *Adenocalymna prasinum*;—Bignonia grandifolia, *Vell.* (non *Mart.*) *Flor. Flum.* 247. vi. tab. 28;—glaberrimum, ramulis teretibus striatis punctato-rugosis; foliis ecirrhoso-conjugatis aut 3-foliolatis, foliolis oblongo-ellipticis, imo angustiore obtusis, apice subacuminatis, obtusiusculis, submembranaceis, supra læte prasinis, reticulatis, subtus valde pallidis, nervis tenuibus secum arcuatis venisque reticulatis prominulis; petiolo petiolulis breviusculis æquilongis; racemis axillaribus et terminalibus, folio brevioribus, tomentosis; calyce 5-dentato, conspicue 2-seriatim glandulifero; corolla speciosa.—Brasilia, *v. s. in herb. Lindl.* (Manneville); *in herb. Mus. Brit.* (A. Cunningham).

Species primo aspectu præcedenti valde similis, sed differt nodis non favoso-punctatis, foliis angustioribus, nervis aliter dispositis, floribus racemosis nec paniculatis, rachi longiore, tereti, nec compressissima, floribus numerosioribus, per paria oppositis, calyce majore, glaberrimo, 5-carinato, nec lævi et tomentello, corolla minore, pulverulenta, nec glabra, &c. Internodia remota; foliola 8–10½ poll. long., 2¾–3½ poll. lat.; petiolus 5–8 lin. long.; petioluli laterales 5–9 lin. long., terminalis 1–2¼ poll. long.; racemi rachis teres aut sub-4-gona, 2–4 poll. long., circiter 20-flora; pedicelli oppositi 3 lin. long., medio bibracteati; bracteæ 5 lin. long., 1 lin. lat.; calyx 4–5 lin. long., 4 lin. lat., glandulis majusculis prominulis instructus, 5-carinatus, nervis extus infra marginem in mucrones protensis; corollæ tubus 18 lin. long., intra calycem coarctatus, medio ventricosus, extus rufescente pruinosus; lobi rotundi, 4 lin. diam.

13. *Adenocalymna acutissimum*;—Bignonia acutissima, *Cham. Linn.* vii. 691; *DC. l. c.* 153;—scandens, præter inflorescentiam tomentosam glaberrimum; ramulis teretiusculis; foliis cirrhoso-conjugatis (interdum 3-foliolatis), foliolis firmulis, ellip-

ticis, basi obtusis, apice acuminatis et longe cuspidatis, lucidis, prominenter reticulatis, margine cartilagineo subreflexo, subtus pallidioribus, nervis venisque prominulis; racemis terminalibus, longiusculis, densifloris, tomentosis.—Brasilia, *v. s. in herb. Lindl.* (Forrest, 26).

Species valde peculiaris, *A. marginato,* DC., proxima: internodia 4 poll. dist.; foliola firma, obscure viridia, nitentia, 3¼–4 poll. long., 1¼–1½ poll. lat. (sec. cl. Cham. folia inferiora multo majora, 9 poll. long., 3¼ poll. lat.); petiolus 6–7 lin., petioluli tenuiores, 5 lin. long., superne canaliculati; cirrhus simplex, tenuiculus, 6 poll. long.; racemi rachis pulverulenta, 4 poll. long., fere e basi florifera, circiter 30-flora; pedicelli oppositi, 4 lin. long. (plerique delapsi), imo bractea 4 lin. long. donati; calyx tubulosus, fulvido-pulverulentus, 5-dentatus, infra dentes glandulis 20 biseriatim dispositis instructus, 4 lin. long.; corolla in alabastro fulvo-tomentosa; maturæ in specim. desunt, sed sec. cl. Cham. 2-pollicares, extus (lobis utrinque) dense farinoso-tomentosæ, intus glabræ.

In the herbarium of the British Museum I find a plant, in fruit, from the neighbourhood of Rio de Janeiro, the seeds of which differ from those last described: the specimen has no flower, so that it cannot be determined to be a species of *Adenocalymna**. The capsule is compressed, not cylindrical as in *A. scansile,* and the valves are proportionally thinner. The seeds are uniserial and much more compressed; the central disk is testudiniform, one of its sides, that of the hilum, being straight, the other rounded and emarginated, while the extremities are broadly expanded into a rather thin but opake wing, which is considerably narrower than the disk; the hilum, instead of being broad, is very narrow, linear, and marginal, corresponding with the cicatrices seen along the margins of the dissepiment. This appears to conform with the brief description by DeCandolle of his genus *Pachyptera,* no specimen of which I have seen. The internal structure of the seed is somewhat different, though approaching that I have given of *Adenocalymna* (see pp. 45, 72): the discoid portion, although coriaceous, is not nearly so

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* I take this opportunity of confirming what I formerly stated (see p. 68) concerning the little dependence to be placed on the calyx as a constant and unerring test for generic discrimination. Perhaps no genus in the family offers a more striking feature than *Adenocalymna,* in its peculiar calyx, which gave origin to its name; but I find in Gardner's collection a plant, allied to *Dolichandra,* with an entire, tubular, coriaceous, pulverulent calyx, marked with polished glands placed biserially below the margin, just as in *Adenocalymna*; and yet it is far removed from that genus on account of the difference of its habit, of its corolla, in the structure of its anthers, its ovary, its thick flat siliquose capsule, and its seeds.

thick as in that genus; its internal space is rendered 2-celled by a very narrow septum, which extends from the hilum to the opposite emarginature of the disk; this septum is fenestrated in the middle (or, rather, interrupted) by a linear aperture for the reception of the radicle; the two cotyledons are compressed, each being divided by deep emarginatures at the apex and base extending to the radicle, which thus occupies a central position, united to the four cotyledonary lobes, the former filling the fenestrated space, the latter occupying the two cells of the disk formed by the narrow septum, as in *Adenocalymna.* The embryo is enveloped by a delicate inner integument, similar to it in form.

In one of my excursions near Tejuco, in a deep forest, I found the ground strewed with seeds of a similar shape and structure, which I still preserve: the plant from which they fell was at too great an elevation to be reached, and I could not find any remains of the capsules. These seeds evidently belong to a different species of the same genus, and are much larger, though resembling the former in every other respect, the discoid portion being 7 or 8 lines in diameter, the wing 5 lines broad, the total extent (including the wings) measuring 2 inches.

The plant in question hardly appears to be a true *Adenocalymna,* and I place it there with some hesitation. *Pachyptera,* in the absence of all knowledge of its floral structure, is still a doubtful genus; but its seminal characters seem to agree with this species. Will *Pachyptera* prove to be a subgenus or section of *Adenocalymna*? This appears probable, because the two species, *foveolata* and *umbelliformis,* which are associated with the type, *puberula,* have the many-foveolated punctures about the axils of the branches, which are almost peculiar to *Adenocalymna* and *Haplolophium.* The *P. dasyantha,* DC., which I have seen, belongs to the latter genus; while the two remaining species, *striata* and *Perrottetii,* appear foreign to the group.

Adenocalymna? *cæsium,* n. sp.; — ramulis teretibus, striatis, pallide glaucis, pilis articulatis dense velutinis, demum subglabris, ad nodos dilatatis; foliis 3-foliolatis aut conjugatis et ecirrhosis, foliolis ellipticis, imo obtusiusculis, aut subacutis, 3-nerviis, apice brevissime attenuatis, obtusis et emarginatis, coriaceis, supra pallide viridibus, opacis, costa mediana nervisque subimmersis cano-puberulis, subtus pallide glaucis, glaberrimis, nervis venisque valde reticulatis, prominentibus, nervo marginali cartilagineo, reflexo, dense poroso-punctulatis, glandulisque paucis immersis signatis; petiolo petiolulis paulo longiore cunctis apice tumidulis, teretibus, dense et sordide cano-tomentellis; racemis axillaribus fructiferis, petiolo dimidio longioribus, glauco-tomentosis; capsula compressa, siliquiformi, late lineari, glauca, subtomentosa, valvis convexiusculis subcrassis; seminibus plurimis, imbricatis, compressis, testudiniformibus, utrinque in alam opacam paulo latiorem expansis.—Prov. Rio de Janeiro, *v. s. in herb. Mus. Brit.* (Itaguahy, in sepibus, A. Cunningham).

Planta scandens, habitu *Adenocalymna comosum* aliquomodo simulans. Internodii 2½–3 poll. dist.; petiolus crassiusculus, 9 lin. long., petioluli laterales 5 lin., terminalis 7 lin. long.; foliola 3 poll. long., 1⅝ poll. lat., terminale paulo angustius et longius; foliola stipuloidea linearia, erecta, eglandulosa, 2 lin. long., 1 lin. lat.; racemi rachis crassiuscula; pedicellus valde incrassatus, 5 lin. long.; capsula 3½–4 poll. long., 6–7 lin. lat., diam. transverso 4 lin.; valvæ convexiusculæ, lineis 3–4 abbreviatis sæpius evanescentibus, subcarinatæ tuberculisque paucis signatæ; replum compressum, utrinque liberum. Semina plurima, transversim elongata, utrinque 1-serialia, compressa, disco crasso-coriaceo, testudiniformia, 6 lin. diam., hilo lineari submarginali 6 lin. long., inclusis extremitatibus in alas opaco-membranaceas expansis 4 lin. lat., 2 poll. longa *.

TANAECIUM.

This genus is remarkable for the extreme length and narrowness of the tube of its corolla, as well as for the peculiar structure of its fruit and seeds. From the evidence here adduced, it will be seen that its structure and affinities have been little understood. Dr. Seemann, in a recent monograph of the genus (Hook. Kew Journ. ix. 81), and again in his interesting Synopsis of the *Crescentiaceæ* (Linn. Trans. xxiii. 1), follows the example of DeCandolle in placing it in that order: he there adopts the mistake of preceding botanists in associating with the typical species the parasitical plant which Swartz had originally, and with much hesitation, conjoined with it; contrary, however, to the diagnoses of DeCandolle, he has been led into the further misconception of ascribing to *Tanaecium* a unilocular ovary and fruit—a structure which I find quite foreign to it. I agree, however, with Dr. Seemann in his conclusion that the *Tanaecium parasiticum*, Sw., to which I have just alluded, is congeneric with the *Schlegelia lilacina*, Miq., a genus unquestionably belonging to *Crescentiaceæ*. Willdenow associated with *Tanaecium Jaroba*, Sw., not only *T. parasiticum*, Sw., but *Crescentia pinnata*, Jacq. As in these two plants the seeds are imbedded in pulp, it was then first incorrectly assumed that the fruit of *T. Jaroba* was also pulpy within; but Swartz, the only botanist who has described it from actual observation, nowhere hints at the existence of any pulp between the seeds, while he notices its presence distinctly in *Tanaecium* (*Schlegelia*) *parasiticum*. The fruit described by me (*ante*, p. 56) sufficiently agrees with the well-detailed account of Swartz of his *Tanaecium Jaroba*; and there can be little doubt of its belonging to that species. It is therefore clear that the generic character given by Dr. Seemann (*loc. cit.* p. 82), excepting some misconception about the structure of the ovary, applies to *Schlegelia*, certainly not to *Tanaecium*. Endlicher, in his 'Genera Plantarum,' bases his diagnosis of *Tanaecium* (4172) entirely upon the *T. parasiticum*, Sw. (*Schlegelia*), and, in a note, points out its generic discordance with the *T. Jaroba*, Sw. (*T. albiflorum*, DC.), which he suggests may probably be a species of *Crescentia*.

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* This plant, with the analysis of the seed, will be seen in Plate 55.

I need not repeat here the description already given (*ante*, p. 56) of the fruit of *Tanaecium albiflorum*, DC. Since that was written, I have seen the fruit of another species (*T. prælongum*), in which there is a somewhat different evolution of the placentæ, which explains the apparent anomaly of the development, so dissimilar in the former case from the usual structure of the order. These two examples are most instructive, and serve to confirm in the strongest manner the hypothesis of the normally 4-carpellary structure of the ovary. The dissepiment is here composed, as usual, of the two chartaceous lamellar plates, united together for the greater part of their breadth; but these plates divaricate when they approach the margins of the valves, and are thus respectively reflected away from each other upon them, as in *Pithecoctenium*, only for a much greater breadth, becoming agglutinated to the inner face of the valves; and the seeds are attached by their very large hilum, partly to the reflected margins and partly to the main portion of the dissepiment. In *T. albiflorum*, the attachment of the seeds is wholly upon the reflected margins of the dissepiment; and when the fruit opens, these four placentiferous portions remain confluent with the two valves, while the main body of the dissepiment breaks away from them, along the line of their inflexion, close to the sutural margins of the capsule; so that the seeds remain as if parietally attached to the valves, while the main body of the dissepiment, thus detached from its seminiferous portions, appears flat, smooth, and naked. The fruit of *T. prælongum* is of the same shape as that of *T. albiflorum*, only somewhat smaller; the ligneous valves are not quite so thick in substance, and they are covered with a closely adherent, coriaceous, rough epidermis, which can be scraped off the more ligneous shell. A similar coating exists upon the ligneous valves of *Adenocalymna*, *Me-*

mora, and some other genera. In both these species of *Tanaecium* the valves split down the middle, as in *Distictis* and *Haplolophium,* and a similar replum detaches itself on each side along the main sutural line of dehiscence. The hilum in *T. prælongum* is considerably curved, and broader, owing to the more thickened margin of the seed on that side, and it lies at a right angle with the axis of the fruit; in *T. albiflorum,* on the contrary, the hilum lies parallel with the axis, when the radicle is therefore centrifugal, while in *T. prælongum* it points a little outwards to the base of the fruit. There is, however, another essential difference to be noticed in these two developments: in the one, the seeds, from their mode of attachment, are pressed and twisted half round, in several series on each side beyond the dissepiment; in the other they are 2-serial, appearing almost uniserial, owing to their different direction and to the greater length and breadth of the hilum.

Tanaecium, therefore, fully corresponds with the conditions of the *Eubignonieæ;* and from the peculiar shape of its large handsome flowers, as well as of its capsule and seeds, it forms one of the most interesting genera of the family. Its place is certainly close to *Adenocalymna.* The generic diagnosis, in accordance with the facts stated, is therefore remodelled, entirely from my own observations, in the following manner:—

TANAECIUM, Sw. (*in parte*).—*Calyx* tubulosus, margine integro, ciliolato, nervis extus in denticulos 5 excurrentibus. *Corolla* valde elongata, anguste tubulosa, apicem versus paulo ampliata et infundibuliformis, limbo expanso 5-fido, laciniis subæqualibus, 2 superioribus erectioribus, 3 inferioribus reflexis, æstivatione valde imbricatis. *Stamina* 4 didynama cum 5to sterili; *filamenta* filiformia, subulata, glabra, summum versus tubi inserta, inclusa; *antheræ* 2-lobæ, lobis linearibus, sagittato-distensis, aut divaricatissimis. *Ovarium* conico-oblongum, glabrum, *disco* carnoso cylindrico sulcato insidens, 2-loculare, pluri-ovulatum; *ovula* in extremis marginibus dissepimenti utrinque pluriseriata. *Stylus* filiformis, longitudine tubi corollæ. *Stigma* 2-lamellatum, lamellis oblongis, obtusis, membranaceis, glabris. *Capsula* magna, late cylindrica, botuliformis, 2-locularis, 2-valvis; *valvæ* lignosæ, medio longitudinaliter fissiles; *dissepimentum* (e lamellis 2 confluentibus) chartaceum, valvis parallelum, aut marginibus placentiferis ad parietem internum valvarum utrinque inflexis, ibi primum agglutinatis et demum solubilibus, vel marginibus seminigeris ad parietem valvarum permanenter conglutinatis et rima utrinque a dissepimento erumpentibus. *Semina* tunc e diversa evolutione placentarum, in uno casu ad dissepimentum,

in altero ad valvarum margines affixa, utrinque 2–3-serialia, imbricata, magna, irregulariter sinuato-rotundata valde compressa, subplana, vel convexa, hinc ad latus hiliferum incrassata illinc gradatim tenuiora; *hilum* aut lineare et rectum, aut oblongum valde convexum et curvatum; *testa* dura, coriacea, brunnea, intus ab hilo usque ad centrum semisepto angusto donata, hinc 2-marsupiata; *integumentum internum* embryonem arcte vestiens, tenuissimum, pellucidum, in sinu superiori *chalaza* parva donatum; *embryo* exalbuminosus, 2-cotyledoneus, *cotyledonibus* orbicularibus, utrinque fere ad centrum 2-fissis, hinc fere 2-lobis, lobis plano-convexis, per paria adpressis, et imo in locellis testæ nidulatis, *radicula* centrali, brevissima, minuscula, horizontaliter centrifuga.

Frutices *scandentes, Antillani, Guianenses et Brasilienses, glabri:* folia *trifoliolata, vel cirrhoso-conjugata;* foliola *oblonga, petiolulata, integerrima*: paniculæ *terminales, pauciflore:* corolla *alba.*

1. *Tanaecium albiflorum,* DC. Prodr. ix. 245; Seem. Kew Journ. ix. 83; Linn. Trans. xxiii. 15;—Tanaecium Jaroba, *Sw. Fl. Ind. Occid.* ii. 1050. tab. 20. f. 1;—Cucurbitifera, *Sloane, Jam.* ii. 175; *Browne, Jam.* 267;—glabrum, foliis 3-foliolatis, vel cirrhoso-conjugatis, foliolis late ovatis, breviter et abrupte apiculatis, imo rotundatis, supra nitidis, utrinque concoloribus, basi 3-nerviis, subtus nervis rufulis venisque transversis reticulatis prominentibus, petiolo longiusculo, petiolulis subbrevibus, striatis; paniculis terminalibus, trichotomis, paucifloris; calyce tubuloso, denticulis 5 e nervis excurrentibus; corolla alba, extus (in sicco) ochraceo-pruinosa, intus glabra; capsula magna, late cylindrica, botuliformi, seminibus crassocoriaceis, exalatis, compressis.—Jamaica, *v. s. in herb. Mus. Brit.* (Robins).

Alte scandens; ramuli teretes, ad nodos compressi, striatuli, lenticellis parvis albidis crebris rugulosi; internodia 5 poll. dist.; foliola $3\frac{1}{2}$–$4\frac{1}{2}$ poll. long. (acumine 6 lin. long.), $2\frac{1}{4}$–$2\frac{3}{4}$ poll. lat. (sec. Swartz. inferiora 6 poll. long.); petiolus $1\frac{3}{4}$ poll. long., petiolulique striati supra canaliculati glabri, laterales impares æquales, 5 lin. long.; cirrhus simplex 3 poll. long.; panicula glabra (floribus exclusis) $2\frac{1}{2}$ poll. long., terque trichotome ramosa; pedicelli 5 lin. long.; calyx 6 lin. long., 3 lin. diam., coriaceus; corollæ tubus $4\frac{1}{2}$ poll. long., ad basin (pro longitudine 2 poll.) constrictus, hinc parallelim cylindricus et 2 lin. diam., dehinc ad os gradatim ampliatus, ore 6 lin. diam.; limbi lobi 9 lin. long., 2 superiores erectiores, alteri reflexi; stamina vidi paululo exserta, eorum locus insertionis, ob corollam insectis excisam, mihi invisus, sed filamenta ex icone Swartzii 3 poll. long., intra tubum 4¼ poll. long.; capsula cylindrica, 7 poll. long. (sec. Swartz. interdum 12 poll.), 3¼ poll. diam.; valvæ lignosæ, 2 lin. crassæ, imo apiceque rotundæ, medio rima longitudinali facile fissiles, interne in fundo flavidæ, nitentes, cum zona longitudinali et utrinque marginali, 12 lin. lat., cancellato-favosa e cicatricibus fuscis opacis linearibus 3–4-serialibus unde semina sessilia affixa sunt; dissepimentum planum, utrinque nitidum, e laminis 2 chartaceis confluentibus, coriaceum, læve, ½ lin. crassum; replum compressum, crassitudine dissepimenti; semina dolabriformia, longitudine transversa 15 lin., latitudine verticali 14 lin., latere externo recte truncato hilifero 2 lin. crassa, dehinc ad latus alterum rotundatum sensim ancipitiformia, crasso-coriacea, dura; hilum cicatrizatum, fuscum, lineare, 13 lin. long., 2 lin. lat.; embryo orbicularis, 9 lin. diam., 1 lin. crassus, utrinque profundissime fissus; radicula brevissima, medio sita, vix 1 lin. long., ad hilum spectans, et ideo centrifuga*.

2. *Tanaecium prælongum*, n.sp.;—scandens, glaberrimum, ramulis teretibus; foliis 3-foliolatis, foliolis ovatis vel oblongo-ovatis, imo obtusis aut subrotundis, apice acute attenuatis, nitidis, nervis venisque transversis reticulatis supra immersis, subtus prominentibus, hinc pallidis; petiolo elongato, petiolulis lateralibus 3-plo, terminali 2-plo longiore; pedicellis longiusculis; calyce tubuloso, margine integro, ciliolato, obsolete 5-denticulato; corolla (sicca) ochraceo-pruinosa, intus glabra, longissime et anguste tubulosa, versus faucem paulo ampliata; genitalibus inclusis; capsula oblonga, cylindrica, dissepimento ad utramque faciem profunde cymbæformi, seminigero, seminibus crassis, coriaceis, imbricatis, adscendentibus, sub-sellæformibus, ala angustissima coriacea.—Guiana Britannica, *v. pl. s. in herb. Hook. et Lindl.* (Schomburgk, 829); *v. capsula in herb. Mus. Brit.*, Guiana (Schomb.).

Præcedente differt foliis 3-foliolatis, foliolis minoribus et angustioribus, petiolo petiolulisque longioribus, pedicellis 4-plo longioribus, corolla 4-plo longiore, tubo tenuiore, staminibus multo brevioribus. Ramuli striatuli, lenticellis parvis favosis sparsim rugulosi; internodia approximata, 6–15 lin. remota; foliola lateralia 3–3½ poll. long., 1½–2 poll. lat., terminali paulo majore; petioli valde divaricati, 2½–2¾ poll. long., petioluli laterales 8 lin., terminalis 16 lin. long.; pedicelli 18–20 lin. long.; calyx 5 lin. long., 4 lin. diam.; corollæ tubus 11¼ poll. long., pro majore parte parallelim angustatus, 2¼ lin. diam., ad insertionem staminum (15 lin. sub fauce) subito ampliatus, fauce 9 lin. diam.; limbi lobi 9 lin. long., obtuse sub-3-angulares,

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* Full details of this structure, and also a drawing of the species, will be seen in Plates 56 and 57.

2 superiores erectiores; stamina brevia, filamenta subulata, glabra, in paribus apice paululo incurvata, 2 longiora faucem non attingentia, 12 lin., 2 breviora 9 lin. long., sterile ultimis intermedium 6 lin. long., rectum, tenue, anantherum; antheræ lobi lineares, obtusi, glabri, angulo recto cum filamento divaricati et verticaliter positi, connectivum apicale obtusum prominulum; stylus tubo æquilongus; stigmatis lamellæ oblongæ, obtusæ, 3 lin. long., 1 lin. lat., glabræ. Capsula botuliformis, 5 poll. long., $2\frac{1}{4}$ poll. diam., dissepimentum cum marginibus bifurcatim reflexis et a valvis solutis (utrinque 6 lin. lat.), 3 poll. lat. Semina irregulariter suborbicularia, dorso convexa, $1\frac{1}{4}$ poll. diam., latere hilifero incrassata, hinc 3–4 lin. crassa, ad marginem oppositum gradatim attenuata, et fimbria coriacea illinc vix alata; hilum 10 lin. long., 4 lin. lat., convexum; structura interna iis *T. albifloræ* simillima*.

3. *Tanaecium Brasiliense*, n. sp.;—scandens, ramis teretibus; foliis inferioribus 3-foliolatis, superioribus conjugatis, novellis longe cirrhosis; foliolis oblongo-ovatis, imo obtusis et ad petiolum breviter attenuatis aut rotundatis, utrinque glaberrimis et reticulatis, textura subtenui, imo 3-nerviis, subtus pallidioribus, nervis venisque transversis reticulatis delicatulis paulo prominulis; petiolo longiusculo, tenui, petiolulis 3-plo longiore; paniculis axillaribus, geminis, 3-chotomis, crebriter paucifloris; pedicellis calyce paulo longioribus; calyce parvo, tubuloso; corolla alba, sicca ochraceo-pruinosa, longe et anguste tubulosa; genitalibus inclusis.—Brasilia septentrionali, *v. s. in herb. Hook.* (Crato, Gardner, no. 1765).

Species a *T. prælongo* et *T. crucifero* valde distincta, ad *T. albifloro* propior: ab isto differt foliis minoribus et angustioribus, textura tenuiore, nervis tenuioribus et minus prominentibus, acumine obtusiusculo, paniculis axillaribus et brevioribus, calyce triplo breviore et angustiore, corollæ tubo longiore coarctato et dimidio angustiore, staminibus multo brevioribus et inclusis. Rami glauci, tuberculis favosis rugosi, juniores læves, fusci; internodia distantia; foliola $2\frac{1}{2}$–$3\frac{1}{4}$ poll. long., $1\frac{1}{2}$–$1\frac{3}{4}$ poll. lat.; petiolus $1\frac{3}{4}$–2 poll., petioluli laterales 6 lin., terminalis 16 lin. long.; cirrhus citissime caducus; paniculæ geminæ (exclusis floribus) 8 lin. long.; pedicelli 2 lin. long.; calyx 2 lin. long., $1\frac{1}{2}$ lin. lat., margine integro ciliolato cum nervis extus in denticulos 5 excurrentibus; corollæ tubus 5 poll. long. (parte basali constricta 4 poll. long. 1 lin. diam., dehinc amplior et ad faucem 7 lin. diam.), limbi lobi 6 lin. long., oblongi, obtusi; filamenta longiora 9 lin. long., apice incurva, faucem attingentia, breviora 7 lin. long., inclusa, sterile 6 lin. long., gracile; stylus glaber, longitudine tubi corollæ; ovarium fusiformi-oblongum, 4-sulcatum, glabrum, disco carnoso solide cylindrico plurisulcato insitum, 2-loculare; ovula pluriseriata, versus extremos margines dissepimenti affixa*.

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* A drawing of this species, with an analysis of its floral structure, and also of the fruit and seeds, is given in Plates 58 and 59.

4. *Tanaecium crucigerum*, Seem. Bonplandia, iv. 27; Hook. Kew Journ. ix. 83; Linn. Trans. xxiii. 15;—Bignonia crucigera, *Linn. Sp.* 869; *DC. loc. cit.* p. 152; *Plum. Pl. Amer.* i. 48, tab. 58;—scandens, ramis teretibus, ad nodos dilatatis, lenticellis globosis tuberculatis; foliis inferioribus 3-foliolatis, superioribus conjugato-cirrhosis, foliolis oblongo-ovatis, acumine brevi acuto, imo obtusis, breviter cordatis et 3-nerviis, supra nitidis, subtus ochraceo-velutinis, nervis ramosis venisque transversis reticulatis nitidis prominentibus; petiolo longiusculo, petiolulis subbrevibus; paniculis geminis, terminalibus; ramis paucis, oppositis, 3-floris, aut abortu 1-floris; calyce tubuloso, margine integro 5-denticulato; corolla extus velutina (in sicco ochracea), intus glabra, genitalibus faucem attingentibus.—In Antillis: *v. s. in herb. Hook.*, Domenica (Imray), St. Vincent (Guilding).

Species a præcedentibus valde distincta. Foliola 5 poll. long., 3 poll. lat.; petiolus 2¼ poll., petiolulique crassiusculi, 6 lin. long.; cirrhus simplex, 5–6 poll. long.; paniculæ geminæ, glabræ, terminales, floribus exclusis 2 poll. long.; rami bijugi cum impari, singuli 3-flori, aut abortu 1-flori, pedunculorum articulationibus sursum gradatim dilatatis et compressis, nitidi et striatelli; pedicelli 3–4 lin. long.; calyx 6 lin. long., 3 lin. diam.; corollæ tubus 6¼ poll. long., pro majore parte ad diam. 2–3 lin. constrictus, dehinc sensim ampliatus, fauce 1 poll. diam., limbi lobi 9 lin. long., obtuse 3-angulares, 2 superiores erectiores, 3 alteri reflexi; insertio staminum 1 poll. infra faucem, filamenta subulata, in paribus, summo incurva, 2 longiora faucem attingentia, 2 altera paulo breviora, inter istas sterile dimidio curtius, rectum, anantherum; antheræ per paria approximatæ, lobi lineares, obtusi, segregati, divaricatissimi, connectivo apicali obtuso breviter excurrente; ovarium conico-oblongum, glabrum, disco latiusculo carnoso impositum; stylus subtenuis, 5 poll. long.; stigmatis lamellæ cuneato-oblongæ, rotundatæ, 3 lin. long., glabræ; fructus vix notus, oblongus, verisimiliter ei *T. albifloræ* consimilis, ut dixit cl. Plum. (*loc. cit.*), "capsulam vulgi repræsentat, quam Tobacco replent, secumque portant."

With this will cease, for the present, my communications on the *Bignoniaceæ*, as I learn from Dr. Seemann that he has re-

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* This species is represented in Plate 60.

sumed his inquiries into that family, and is about to publish the results of his investigations. The respect I have for that zealous botanist, together with the desire on my part to avoid contravention, and the knowledge that he has long studied the subject, induce me to cede to him the priority. As he has the advantage of consulting collections to which I have no means of access, more may be anticipated from his exertions. I reserve to myself, however, the right of resuming the subject at a future time, and of carrying out my original plan of defining the limits of the genera and subgenera I have sought to establish upon features hitherto unobserved, and also of illustrating their characters by drawings of one or more species of each group, accompanied by analytical figures of the flower, fruit, and seed.

On the History of the Maté Plant, and the different Species of Ilex employed in the Preparation of the 'Yerba de Maté,' or Paraguay Tea.

Notwithstanding the seemingly authoritative evidence we have on record concerning it, I have entertained a doubt for many years past in regard to the plant which produces the celebrated Paraguay Tea, the favourite beverage of the Spanish South Americans. I will here detail the results of my investigations into this subject, and will preface the inquiry by a short history of the events which had great influence on the production and trade of this article of commerce: these events are the more interesting as they are in some degree connected with the biography of the celebrated botanist Bonpland, to whom I am indebted for the knowledge of the true plants which produce the Yerba.

In the settlements of the Indians in Paraguay and along the borders of the River Paraná, under the dominion of the Spanish government, administered as they were at that period by the Jesuits, the preparation of the Yerba constituted the principal branch of industry of the country. The plant from which the Maté is prepared was first mentioned by Azara, as growing wild in many parts of Paraguay. It is found in great abundance in all the moist valleys of the ramifications that branch from the main chain of mountains called Maracajú, which, rising in that part of Paraguay bordering upon Matto Grosso, in lat. 19° S., and tending S.E., divides the northern half of the country into two distinct watersheds—the rivers flowing westward running into the river Paraguay, and those eastward into the Paraná. This chain, after a length of 150 miles, suddenly takes a more easterly course, and is soon cut through by the latter river at a place called Sete Quedas (seven cataracts or large rapids), in lat. 24° S.; it then crosses into the Brazilian province of San Páolo, through which it runs nearly due east for 300 miles, as far as Curitíba, where it becomes blended with the main chain of the Serra do Mar, that skirts the coasts of the southern provinces of Brazil. The Yerba-tree is found more or less abundantly in all the valleys that branch out of this extensive range of mountains, but principally, as before mentioned, in the northern portion of Paraguay. Wilcox, in his 'History of Buenos Ayres,' mentions three kinds of Yerba known in commerce—"the *Caácuy*, *Caámini*, and *Caáguazú*:" the first is there said to be prepared from the young leaves recently expanded from the buds; the second is from the full-grown leaves, carefully picked and separated from the twigs; and the third from the older leaves, carelessly broken up with the young branchlets: all being half-roasted by a crude process. But I have always been of opinion that these several qualities were prepared from different species of *Ilex*. The Guarani general term, *Caá*, signifies a leaf or branch; and in the Missions, the names of *Caá-riri* and *Caá-úna* or *Caúna* are given to the different kinds of *Ilex*. The prepared leaves have always borne the name of *Yerba* among the Spaniards, its infusion being made in a peculiar kind of cup called a *Maté*. In the Portuguese Missions the Yerba is called *Caúna*, and in most of the Brazilian provinces it is known by the name of *Congonha**.

Under the Spanish government, the principal harvests of Yerba were made in the valleys bordering upon the river Ypané, a tributary of the Rio Paraguay,—the produce there collected being conveyed to the town of Villareal, at its mouth, in lat. 23° 30′ S., and thence transported down the River Paraguay, in large pontoons, to the metropolitan town Assuncion. Although the largest harvests were obtained in Paraguay, considerable quantities in addition were raised in the various settlements of Indians founded by the Jesuits beyond its limits. These were called Missions, and were thirty in number, twenty-three being situated between the rivers Paraná and Uruguay, and seven on the left bank of the latter river, in the province of Entrerios. These, as well as all the extensive settlements in Paraguay proper, were at their greatest prosperity at the period of the expulsion of the Jesuits in 1768; but, owing to the defective management of the Indians under the subsequent rule of the Spanish authorities, the commerce in Yerba languished considerably. In 1810 the quantity raised was supposed to amount to five millions of pounds; but Mr. Robertson states that in 1812 (two years after Paraguay became independent) the exports of Yerba still amounted to eight millions of pounds, or 3750 tons, from the port of Assuncion alone, at which period, too, its cultivation in the Missions had become almost annihilated. In all these Missions, during the devastating wars then raging throughout the Argentine provinces, the Indian settlers were robbed of all their cattle and horses, their farms were destroyed, the men forced to become soldiers, and otherwise were so oppressed, that the greater number sought a refuge in Paraguay. Some idea of the extent of this depopulation may be formed from the records preserved of the seven Uruguay Missions, which in 1768 had a population of 30,000, nearly all Indians; in 1801, when taken by the Portuguese, they numbered only 14,000; by the subsequent wars they were further reduced, in 1814, to 6395; and in 1821, at the census taken when St.-Hilaire was there, they scarcely amounted to 3000 individuals of all ages. This celebrated botanist remarks concerning them—"En un mot, la province des Missions, naguère si florissante, offre aujourd'hui le tableau de toutes les misères qui affligent notre espèce, et dans peu, l'on y chercherait vainement des Indiens." Owing to political causes subsequent to 1812, the trade with Paraguay became in great measure suspended; so that the Yerba from the Curitíba Mountains was much sought for, and conveyed to the nearest port of Paranaguá, on the Brazilian coast; and hence the Yerba de Paranaguá (though considered inferior in flavour to the Yerba de Paraguay) commanded a ready sale: but the quantity obtained from this source was inconsiderable in comparison with the amount that still found its way from Paraguay.

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* Pronounced *Congonia*.

At this period, Paraguay was governed by the renowned Dictator, Doctor Francia. That country had been one of the earliest of the Spanish provinces in assuming its independence: this occurred in 1810, when Francia was one of the Junta deputed to frame a constitution after the republican model, with the executive power confided to two consuls chosen by the people. At the end of the second year he was elected one of the consuls; but soon after, his colleague was superseded, and all the power became vested in his hands. His government, in most respects, proved well suited to a race of Indians still imbued with the highest respect for the paternal rule of the Jesuits, under whom they were accustomed to an implicit obedience to one superior head. The population everywhere spoke the Guarani tongue, and only the more educated men in authority and the few settlers from the mother country could understand the Spanish language; on the other hand, the Indian language was not spoken in any of the Argentine Provinces. The system of government adopted in Paraguay was completely at variance with that followed in all the Argentine Provinces, where the rule was based upon the more democratic model of the North American States, which enjoined the annual election of the municipal officers, whose executive power was always supposed to be controlled by a representative and legislative assembly triennially chosen by universal suffrage. The Paraguayans, however, preferred their own system, and were so fully confident in the talents and integrity of Dr. Francia, and so well satisfied with his rule, that he was soon afterwards, by universal consent, elected perpetual Dictator, with the most ample powers to act as he judged best for the interests of the country. His government was quite patriarchal: he required no large standing army to overawe the people, who were only too willing to follow his injunctions; his military force was not larger than was necessary to form a sort of custom-house guard round the coast, as well as to prevent the ingress of the many adventurers and partisans from the adjoining provinces who sought to disturb the system he had established. He had previously followed the legal profession, and, as a civilian educated under the Jesuits, his policy was based on a desire for peaceful quiet; and in all his measures he sought to prevent the contagion of that military turbulence which agitated the surrounding states, and which kept them in a constant state of anarchy. Paraguay, when under the Spanish rule, had been dependent upon those states for most of the necessaries of life, which they exchanged for its Yerba and its tobacco; and Francia's earliest efforts were directed so as to render the country independent of this foreign supply and to produce whatever was essential for its own requirements. The only persons who strove to thwart his measures were the old Spaniards, who clung to the hope of seeing the power of Spain restored, and also the many emissaries clandestinely sent from the neighbouring states to allure the people into another policy, and to restore the former state of trade on which they had depended. Against these emissaries, acting in concert with General Artigas, Governor of Entrerios, who invaded Paraguay and laid waste parts of the country, the most stringent measures were employed: they were threatened with the extreme penalty of the law, if caught in their intrigues; and several daring adventurers, though forewarned of the consequences, were taken, and suffered the punishment of death as examples to others. The many tales raised against Francia for cruelty and murder are solely traceable to these severe measures, which he considered just and necessary. Towards the natives no such severity was required; for his administration of the law was simple, firm, and just: had it been otherwise, it would have been impossible for him to have maintained his authority for so many years without a standing army; and we have the strongest evidence of this truth in the fact that, during his long administration, notwithstanding the efforts of many foreign emissaries, no attempt was ever made among the people to revolt; no Paraguayan endeavoured to control his power, or change the system he adopted. We have the evidence of Mr. Robertson (one who suffered most from the suspension in the trade in Yerba, and who was in consequence one of the foremost among his detractors) that during his residence of two years in Paraguay, under Francia's rule, no instance of the punishment of death was known.

Under the Spanish rule, the Paraguayans had cultivated, besides the Yerba, little beyond a fine kind of tobacco (considered equal to that of Havanna, and much appreciated in Chile and Peru), and also some sugar and yucca (yams). They were soon induced by Francia to extend their agricultural pursuits, to cultivate rice, maize, and other vegetables, on a large scale, and to raise a sufficient quantity of yucca to satisfy the general consumption. Other vegetable products, hitherto scarcely known in the country, soon covered the plains: cotton, formerly procured from Corrientes, was now cultivated to some extent; more attention was paid to the rearing of cattle and horses, instead of importing them from Entrerios, so that in a few years they were able to export a considerable surplus above their own requirements; and they now made cotton cloths for their garments, in lieu of the woollen ponchos obtained from Cordova. The Dictator for many years was assiduous in his endeavours to establish permanently this system of industry, which necessarily supplanted in great measure the trade in Yerba; he even employed coercive measures in order to carry it into effect; and in 1829 he decreed that the possessor of every house or farm should sow a certain quantity of maize, upon the product of which every one was bound to contribute 4 per cent. to the state, no excuse being allowed; and those who sought to evade this obligation became subject to heavy penalties.

I had many opportunities, during my residence in Buenos Ayres in 1825–1827, of conversing with several persons who had been in Paraguay, but I never met with any one who had witnessed the atrocities currently ascribed to the Dictator: from all I could learn, I became convinced that the character so generally assigned to Doctor Francia was not founded in truth, and that, owing to political jealousy and personal dislike, he has been unjustly maligned. He ought, on the contrary, to be looked upon as a great benefactor to his country; and though he had recourse to a policy of restraint, which in a more advanced state of society would not have been tolerated, it was certainly one well calculated, in the actual state of Paraguay, to attain the objects he had so much at heart, and in which he gradually succeeded. The good results of these wise measures are well attested by the prosperous advancement of the country up to the present time. His success naturally raised up against him a host of irreconcileable enemies in all the Argentine Provinces, who strove to blacken his character and vilify his conduct. All these Provinces, suffering under the extinction of the trade in Yerba, were leagued against the policy of Francia; but their attention being too much occupied in their constant internecine wars, they had little time or force to spare in the attempt to revolutionize Paraguay. At length, however, the Governor-in-chief of Entrerios, having made peace with the other provinces, turned his attention to that object, and endeavoured at the same time to establish settlements at the former Jesuit Missions (then almost depopulated), with the view of cultivating the trade in Yerba. And we now come to a knowledge of the state of affairs that existed when the celebrated Bonpland visited the River Plate, and how the subsequent phases of his life became connected with the history of the trade in Yerba.

The fall of the emperor Napoleon and the re-establishment of the Bourbon dynasty in France were events most galling to Bonpland, and he resolved to seek an abode in one of the republican States of South America. Accordingly he reached Buenos Ayres in 1817, with a nominal appointment of Professor of Natural History in that capital. About the same time, a considerable number of his countrymen, from similar causes, settled themselves in the Argentine Provinces, at which period the internecine wars before alluded to were raging furiously. Many of these Frenchmen became active partisans in these quarrels, and, either by their direct or indirect interference, soon came under the ban of the several opposing chiefs. When I passed through Buenos Ayres, in 1819, I saw Bonpland; he was then under great excitement in consequence of the execution of two of his companions, who, having been detected in assisting the military chief Carrera, were accordingly sentenced to be shot. It was in the same year that Bonpland established himself near Candelaria, one of the old Jesuit Missions on the left bank of the Parana, contiguous to Paraguay, where he formed a considerable establishment, chiefly, as I understood, with a view to the production of and trade in Yerba, under the special auspices and protection of the Governor-general Artigas, who, as I have before mentioned, intended ultimately to carry out his designs against Paraguay. In the following year, General Ramirez, who commanded Artigas's forces, being bought over by the rival

Presidents of Buenos Ayres and Santa Fé, revolted against his chief. Artigas, being hard pressed and deserted by his supporters, knowing also that if he fell into his enemies' hands he would be immediately sacrificed, resolved to beg an asylum in Paraguay; and he obtained this permission, in 1820, from Doctor Francia, for himself and a thousand of his faithful followers, who were distributed in different parts of the country, and to whom portions of land were assigned, upon condition of cultivating them. The Dictator generously gave his rival a monthly pension, together with a house and lands in the village of Caragaty, eighty-five leagues N.E. of Assuncion, where he resigned himself to peaceful agricultural pursuits, and lived in much enjoyment till the period of his death, ten years afterwards.

In 1821, Ramirez, being then at peace with the other Argentine provinces, turned his attention to the invasion of Paraguay, with which view he collected a considerable body of troops, in order to force that country to adopt his policy. While these preparations were going forwards, political considerations of greater moment induced Ramirez to suspend his project: he now marched his forces to the southward, to wage war against the Governors of Buenos Ayres and Santa Fé; and after a severe campaign, he was at last defeated, taken prisoner, and executed. Francia, thus relieved of his fears for a while, proceeded to adopt such precautionary measures as he conceived would place his country for the future in greater security; and in these measures Bonpland became deeply concerned.

Doctor Francia suspected this celebrated botanist of being in concert with General Ramirez, knowing also that he had previously been the friend of General Artigas. Francia was well informed of all the combinations making against him; and his conviction that Bonpland was implicated in these measures appears to have been heightened by the formal application which the latter made to him, about this period, to be allowed to enter into commercial relations with Itapuan, on the opposite coast of Paraguay, presenting at the same time, in earnest of his intentions, a contract he had formed with an Indian cacique for the purpose in view. Had Bonpland abstained from meddling with political questions, it is probable he would never have been disturbed; but after Ramirez had given up his intended invasion, Francia availed himself of the opportunity by sending a force of 400 men across the Parana to Candelaria, near the place of Bonpland's residence, to destroy that post, which he considered to be the nucleus whence hostile demonstrations might at any future period be formed against his country: he likewise ordered them to make prisoners of certain persons, among whom was the former companion of Humboldt. These instructions were implicitly carried into effect, and Bonpland was conveyed a prisoner to Assuncion. The Dictator received him with every demonstration of respect and kindness, explaining the motives which justified him in the course he had taken, and offered him any place he might select in the interior, as he had previously done to Artigas. Bonpland chose to fix himself at Santa Maria, to the S.E. of Assuncion, where he enjoyed full liberty, and was subject to no other restraint than the obligation of remaining peaceably in its neighbourhood. Here he settled upon the farm assigned to him, and practised also as a physician. He appears to have lived there in great contentment for ten years, at the end of which time he received from Francia full liberty to depart whenever he pleased. The best proof that Bonpland was satisfied with the treatment he received, is that he never protested against his captivity, and that he refused (I believe, for a period of two years) to avail himself of the liberty given to him; and it is certain that he then declined the many pressing invitations from Buenos Ayres, sent to him by the foreign ambassadors and other distinguished persons, who had greatly interested themselves in his welfare. At length he made a visit to the River Plate, but remained there only a very short time, for he soon returned to the Missions, and finally established himself on his former estate of S. Anna de la Restauracion, not far from Candelaria in Corrientes, bordering upon Paraguay, where he lived, much respected by all, till his death in 1858.

From his long residence in the country, and his great experience in all that relates to the preparation of Yerba, no one had better opportunities than Bonpland to identify the real species from which that article of consumption is manufactured.

The system of the merchants in their agreement with the 'habilitadores' who undertake the quest of Yerba in the distant forests of Paraguay, the manner of hiring the Indian labourers for this work, the preparations for feeding them during their long bivouac, the mode of collecting and drying the branches, roasting and separating the leaves, pounding them, and packing the Yerba, thus prepared, in hide bags, are well described in Mr. Lambert's memoir on the *Ilex Paraguayensis*, and in Mr. Robertson's 'Letters from Paraguay, and Francia's Reign of Terror.' The same rude methods were employed in all the Spanish Missions, and also in the Brazilian settlements, up to a very recent period; but of late years more improved processes, upon a much larger scale, have been brought into use about Curitíba; but in the province of Rio Grande the old system is still continued. At Curitíba, I am told, the leaves are now roasted more equally, in cast-iron pans set in brickwork, much after the manner in which tea is prepared in China, except that the pans are much larger. When the leaves are sufficiently dried, they are pounded in stamping-mills worked by water-power or steam-engines, and packed in bags by means of presses. The quality of the Yerba has thus been much improved.

We owe to St.-Hilaire the first outline of the botanical features of the tree, growing about Curitíba, that yields the Yerba: it was only a short diagnosis, published in 1822 *, when he ascertained it to be a species of *Ilex*, which he considered identical with the Paraguay plant, and which was named inaccurately, through a typographical error, *Ilex Paraguariensis* †, a name he afterwards abandoned in 1824 for that of *Ilex Matte* ‡; he, however, resumed the former name in 1833 §. In the meanwhile, Mr. Lambert, in 1824 ||, gave a much fuller description of the plant, accompanied by a good drawing made from specimens sent from Buenos Ayres, and probably obtained from one of the Spanish Missions: he called it *Ilex Paraguensis*.

I had always been impressed with the conviction that the different qualities of Yerba brought to market were prepared from different species of *Ilex*; and hence the doubt occurred to me whether the plant described by St.-Hilaire from Curitíba be really identical with the true Paraguayan type. The grounds for this surmise were founded upon the dissimilar colour of the two Yerbas, the difference in their flavour, and the higher price always obtained for the Yerba de Paraguay compared with the Yerba de Paranaguá. The short diagnosis of St.-Hilaire answered equally to several species that I had seen. Sir Wm. Hooker, in 1842¶, gave a very interesting account of the Yerba, describing also the *maté* or cup, formed out of a small calabash (*cuy*), in which the infusion is prepared, and out of which it is drawn into the mouth through a *bombilla*; he added the characters of the different varieties, which he considered identical with the *Ilex Paraguayensis*, and of these he gave two excellent figures with analyses. This memoir, instead of solving my doubts, only rendered the question still more enigmatical; for in it is classed, as a mere variety, a plant which I brought from Rio de Janeiro, which I found growing in the Botanic Gardens there, and which I was assured by the Rev. Frey Leandro, at that time Director of those Gardens, was the "Arbol do Maté," or 'Paraguay Tea-tree.' This plant, which is well figured in

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* Mém. Mus. ix. 351; Spreng. Syst. iv. cur. post. p. 48.

† Dr. Reisseck (Fl. Bras. 28. p. 115) thinks the word "Paraguariensis ita forsan rectius scribitur pro Paraguayensis;" but this cannot be. The word is unquestionably used adjectively for the country Paraguay. There is no place known by the name of Paraguari. St.-Hilaire found his plant near Paranagua, but that could never have suggested the word in question. It was at first, no doubt, a mere typographical error, which St.-Hilaire did not think necessary to correct afterwards.

‡ Hist. des Plantes remarq. de Brésil et Paraguay, i. Introd. p. xli.

§ Voy. Diamant, i. 273. || Lambert, Pin. ¶ Lond. Journ. Bot. i. 30.

Sir Wm. Hooker's memoir *, appeared to me quite a distinct species, marked by very peculiar characters.

Anxious to remove this doubt, I applied to my friend Senr. Conselheiro Candido Baptista d'Oliveira, soon after I learned of his appointment as Director of the Botanic Garden, and begged of him to ascertain whether that plant was really identical with the tree which yields the true Yerba de Paraguay, as I had been assured twenty years before, or a different species, and to send me, if possible, authentic specimens of both. He most obligingly forwarded me a fresh specimen of the tree still growing in Rio de Janeiro, and at the same time transmitted my application to M. Bonpland, as the most competent authority on the subject, who, however, did not quite comprehend the object of my inquiry. This renowned botanist most kindly responded, and sent six different species, with their varieties, all collected in the Missions, and all alike used in the preparation of Yerba. This at once confirmed my suspicion that more than one species of *Ilex* is employed for that purpose; and as this fact is of some importance in the history of the subject, I will copy here *verbatim* the note of M. Bonpland which accompanied his specimens.

The note, in M. Bonpland's handwriting, accompanying the specimens sent by him, is as follows:—

"No. 596. Herbe du Paraguay—Maté—*Ilex theæzans*, Bonpland—*Ilex Paraguayensis*, St.-Hilaire. Se trouve dans le Paraguay, le Brésil, et Entre Rios.

"No. 2425. *Caúna* des Brésiliens—*Ilex ovalifolia*, Bonpl., nouv. espèce. Se trouve dans le Faxinal, au sortir de la Picada de S^{a} Cruz, à 4 lieues du Rio Pardo.

"No. 2333. *Caúna* des Brésiliens—*Caachiriri* ou *Caachiri* des Guaranís—*Ilex amara*, Bonpl., n. esp. Se trouve dans les montagnes de S^{a} Cruz et dans les forêts du Paraná.

"No. 2332. *Caúna* des Brésiliens—*Caachiriri* des Guaranís—*Ilex crepitans*, Bonpl., n. esp. Se trouve dans les bois de Guayaraça dans le cœur de S^{a} Cruz et sur les bords du Paraná.

"No. 2330. *Caúna de folha larga* des Brésiliens.

"No. 2374. *Caúna amarga* des Brésiliens.

"No. 2479. *Caúna* des Guaranís—*Ilex gigantea*, Bonpl., n. esp. Se trouve dans les bois de S^{a} Cruz et sur les bords du Paraná.

"No. 2471. *Caunina* des Brésiliens—*Ilex Humboldtiana*, Bonpl., n. esp. Se trouve dans le Picada de S^{a} Cruz qui conduit à Rio Pardo, Prov. Rio Grande, Brésil.

"Toutes ces espèces d'Ilex sont employées à faire de l'herbe Maté. Les nos. d'ordre correspondent à mon journal botanique.

"Corrientes, 17 Juin, 1857." "AIMÉ BONPLAND."

When in Paris three years ago, I endeavoured to ascertain whether any of these specimens agreed with St.-Hilaire's typical plant; but the latter, unfortunately, had been mislaid or lost in the removal of the collections exhibited in the great 'Exposition' of 1855. St.-Hilaire states that he had compared his plant from Curitíba with specimens from Paraguay, and found them specifically identical: this conclusion does not correspond with the specimens before me.

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* Lond. Journ. Bot. i. 35, var. γ, tab. 3.

I have since obtained from Curitíba a specimen of the plant there used in the preparation of the Herva de Paranaguá. On comparing it with the true *Ilex Paraguayensis* sent by Bonpland, I find the two sufficiently distinct, as will be seen by the diagnoses that will follow: this fact is of interest, as it accounts at once for the difference in the quality of the tea respectively prepared from these two plants.

Hitherto I have spoken only of the Yerba produced from these two species. Bonpland, however, states positively that the other species, of which he sent specimens, are also employed in the preparation of the Yerba of commerce. This fact has lately been confirmed by the assurance I have received from a Brazilian gentleman from Porto Alegre, who trades extensively in this commodity: his information is very interesting, both as regards the difference in the quality of these products, and the districts in which the trees are found; and from his knowledge of this matter and his long experience, his account may be fully depended on. The other species grow principally in the districts that stretch far to the eastward and southward of the long mountain-range which extends from the "Serra Géral" of Curitíba, in lat. 26° S., to lat. 32° S., where it is shown in the maps as the "Serra do Herval," so called from the abundance of its Maté trees. The summits of this wide-spread mountain-range are very broad, forming numerous table-lands which afford excellent pasturage for cattle. The Maté trees are never found on these table-lands, nor in the broad plains that skirt the river-beds: they grow invariably on the inclined hill-sides in the numerous gorges intersecting the country, which in most cases are densely wooded; and it is in these woods that the different species of *Ilex* abound. In some places the Maté trees attain a considerable size, often exceeding 100 feet in height. These larger trees grow especially on the declivities of the western side of the same mountain-range, where all the streams flow into the river Uruguay. The Yerba here produced is of an excellent quality: that called by the Brazilians "Herva de Palmeira" is renowned as being equal to the best Paraguay tea.

It is in this region that seven of the far-famed Missions established by the Jesuits are situated, where the Maté is extensively collected. Upon the eastern declivities, along the tributaries of the rivers Pardo and Jacuhy, are the 'Hervales' of Faxinal, Santa Cruz, and Guayaraça, to which Bonpland's specimens refer. Here also is that of Butacarahy, equally renowned, where the *Ilex gigantea* of Bonpland abounds, and where it attains a height of 70 feet: the other four kinds, with smaller and more lanceolate, punctate leaves, rarely here exceed the height of 30 or 40 feet. The latter are more irregularly branched, with a more straggling growth, and they produce the sort called by the Brazilians *Herva brava* (wild Maté), while the larger-leaved species, such as the *Ilex gigantea,* yield a kind of tea called *Herva mansa* (mild Maté); such trees have straighter trunks, with more regular and rounded heads. The former sorts have a more bitter and stronger flavour, and want the peculiar and more agreeable aroma of the Paraguay type. When, however, the Herva brava is mixed with the Herva mansa in the proportion of 1 in 3 or 1 in 4, it produces a kind of Maté which is hardly distinguishable from the genuine Paraguay Yerba; and it thus forms a considerable object of commerce.

Still further to the southward of the Serra do Herval, in the mountain districts of the Taypes or Canguassú, some species of *Ilex* abound which are said to produce a tea as valuable as the best sorts of Herva de Palmeira, or even vying with the Paraguay tea, being equal to them in fragrance, flavour, and strength. This fact is worthy of notice when we take into consideration the great difference in the latitude of these districts. The quality of the tea of all these various kinds depends greatly on the time of year in which the leaves are gathered, the best season for the harvest being well known to the natives.

Dr. Reisseck has lately published, in Martius's 'Flora Brasiliensis,' a Monograph of the Brazilian species of *Ilex.* He evidently had not seen any specimen of the true *Ilex Paraguayensis*; for his diagnosis under that name refers to some of the smaller, more lanceolate, and punctate-leaved species of the genus, and certainly not to the celebrated true Paraguayan plant.

I now present the characters of the several Maté plants that have been here referred to:—

1. *Ilex Paraguayensis,* St.-Hil. in Spr. Syst. iv. cur. post. p. 48; Hook. (in parte) Lond. Journ. Bot. i. 35. tab. 1;—Ilex Paraguariensis, *St.-Hil.* (*in parte*) *Mém. Mus.* ix. 351; *DC. Prodr.* ii. 15;—Ilex Paraguensis, *D. Don in Lamb. Pin. App.* p. 7. tab. 4;—Ilex theæzans, *Bonpl. MSS.* (*non Mart.*);—ramulis angulato-striatis; foliis oblongis vel obovato-oblongis, coriaceis, glaberrimis, integris aut obsolete aut profundius grossedentatis, margine revoluto, utrinque concoloribus, nervis superne vix distinctis, subtus prominulis, reticulato-venosis, epunctatis; petiolo canaliculato; inflorescentia in axillis pluriflora; pedunculis 4–6, subfasciculatis, e nodo bracteato ortis, petiolo sublongioribus, interdum 1-floris, vel medium

versus 2–3-fidis, cum pedicellis 1-floris; floribus in ♂ 5-meris, in ♀ 4-meris, glaberrimis; sepalis parvis, rotundatis; petalis oblongis, reflexis, calyce 4-plo longioribus; drupa glabra, piperiformi; nucibus 5, singulis stria mediana prominula carinatis.—Paraguay; in Brasilia australi introducta.

Type *a*.—In the typical specimen sent to me by Bonpland as the real Paraguay species, the leaves are very entire, or sometimes with only a slight indication of distant teeth near their summit; they are quite opake above, nearly concolorous: the upper surface is smooth and almost nerveless; but the nerves, when present, are slender and prominent beneath. They are 3¾ inches long, 1¾ inch broad, on a petiole 3 lines long: about four very slender fasciculated peduncles issue from an axillary stipitiform nodule, each bearing three one-flowered pedicels: the peduncle measures 3 lines, the pedicels 2 lines, with a globular flower-bud 1 line in diameter: sometimes one or two of these pedicels are wanting, in which case the peduncle is 5 lines long and 1-flowered. The specimen was collected at Candelaria, in the province of Corrientes, "in a wood planted by the Jesuits." —*Herb. Bonpl.* no. 596*.

Var. *β. idonea*, nob.;—foliis crassioribus, rachi subtus crassiore.

In this variety (sent with the preceding, without any locality) the leaves are thicker and obsoletely dentated all round their margin, which is revolute; above, the nervures are distinct and the midrib is thicker; the blade is 3¼ inches long, 1¼ inch broad, on a petiole of 5 lines. The specimen is without flower or fruit†.

Var. *γ. dentata*, nob.;—foliis e medio usque ad petiolum cuneatis, grosse dentatis, dentibus obtusis glandula minima donatis; fructibus piperis magnitudine.

The leaves are here more deeply and obtusely toothed for two-thirds of their length, the lower portion being quite cuneiform and entire; they are somewhat shining above, very smooth, with immersed nervures; the lower face is opake, with prominent fine nervures, the midrib being much raised; they are 3 inches long, 1½ inch broad, on a petiole of 5 lines. The specimen is in fruit; the pedicels are fasciculated on a short nodule, and are either 1- or 3-flowered and 5 lines long; the drupe, seated on a 4-lobed calyx, is globular, 2 lin. diam., crowned with a thin, flat, sessile, 4-lobed stigma. The plant is probably from one of the old Jesuit plantations on the Uruguay‡.

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* A drawing of this plant is given in Plate 61 A.

† A sketch of this variety will be seen in Plate 61 B.

‡ An outline of this variety will be seen in Plate 62 A.

Var. δ. *usitata,* nob.;—foliis e medio ad basin cuneatis, breviter et remote dentatis, dentibus glandula mucronulatis, margine paulo reflexis; corymbo petiolo 2-plo longiore, e basi ramoso, ramis 3–4-floris, pedicellis longiusculis, tenuissimis, umbellato-fasciculatis, imo bracteolatis; floribus 4-meris, glaberrimis, parvulis; drupa piperiformi.—Prov. San Páolo (Gaudichaud, no. 57).—An species distincta?

The leaves are 3–3½ inches long, 1⅜ inch broad, on a petiole of 5 lines; they are more finely toothed than the preceding: the primary branch of the axillary corymb is 2 lines long, the five or six fasciculated branchlets 3 lines, and the three pedicels at the extremity of each 2 lines long; the expanded flower is 2 lin. diam. Both the ovary and ripe fruit are crowned with a flat sessile stigma, as in the Paraguayan type; the drupe is globular, and nearly 3 lines in diameter*.

2. *Ilex Curitibensis,* nob.;—Ilex Paraguariensis, *St.-Hil.* (in parte) *Mém. Mus.* ix. 351; *Voy. Diam.* i. 273; *DC. Prodr.* ii. 15;—Ilex Maté, *St.-Hil. Pl. Remarq.* i. 41;—glaberrima, ramulis teretibus, angulato-striatis, fuscis, lenticellis notatis, junioribus subcompressis, acute 4–6-gonis; foliis elliptico-oblongis, imo cuneatis, apice breviter et repente acuminatis, acumine obtuso aut emarginato, grosse dentatis, dentibus paucis obtusis valde gibbis et apice glandula mucronatis, subcoriaceis, rigidulis, supra fuscescentibus, nitidis, costa nervisque omnino immersis, subtus pallidioribus, subferrugineis, opacis, epunctatis; petiolo longiusculo, canaliculato; floribus ♀ paucis, in axillis fasciculatis, 4-meris; drupa ovata, stigmate pulvinato 4-lobo coronata, nucibus 4.—Prov. San Páolo, *v. s.* ex sylvis prope Curitíba; *etiam in hb. Delessert,* Sorocába (Sellow).

This must be the plant collected by St.-Hilaire at Curitíba, and considered by him to be identical with the Paraguay species, which he does not appear to have seen; the two plants, however, are manifestly different. Here the branchlets are very angularly sulcated, shining, and, as well as the leaves, grow nearly black in drying; the leaves are more distinctly cuneate, the dentations are fewer in number, and consequently larger, deeper, very obliquely rounded, each tooth having near its sinus a short acute mucronate gland; the opacity on the lower side is caused by the presence of very minute and crowded granulations, which are very manifest under a lens: they have no immersed black glands, as in Reisseck's second section of the genus; the midrib is somewhat prominent below, polished, and very dark. The leaves are 3–4 inches long, 1½–2 inches broad, on a petiole 6 lines long: the drupe is oval, 2½ lines long, 2 lines diam., supported on a 4-lobed calyx, and crowned with a prominent, pulviniform, 4-lobed stigma; it encloses four nuts*.

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* This variety is shown in Plate 62 B.

Var. *Gardneriana*, nob.;—Ilex Paraguayensis, *Hook.* (*in parte*) *Lond. Journ. Bot.* i. 35. tab. 1;—ramulis opacioribus, foliis non fuscescentibus, coriaceis, supra nervis venisque reticulatis subconspicuis, ad costam profunde sulcatis, subtus pallidioribus. An species distincta?—Prov. Rio de Janeiro in Montibus Organensibus (Gardner, no. 346), *v. v.*

This plant is well represented by Sir Wm. Hooker, in the drawing above cited, under the name of *Ilex Paraguayensis*, var. *a*. It is a small tree, about 15 feet in height: its leaves are 2½–3 inches long, 15–18 lines broad, on a nearly terete slender fuscous petiole 5–6 lines long; their margin is much reflexed, with a very acute uncinate gland on the apex of each tooth, close to the sinus: the under side, viewed through a lens, presents a similar minutely granulated surface, and is quite epunctate. My specimen has no fruit; but that in the Hookerian herbarium had a single drupe, which is of a globular form, 2½ lines diam., crowned with a depressed, pulvinate, 4-lobed stigma, as shown in the plate referred to.

3. *Ilex gigantea*, Bonpl. MSS., n. sp.;—arbor excelsa, glaberrima, ramulis subrugosis, junioribus angulatis, lenticellatis; foliis cuneato-oblongis vel obovatis, apice rotundatis vel retusis, hinc brevissime acutis aut mucronatis, integerrimis, margine incrassato valde revoluto, crasso-coriaceis, supra nitidulis, costa nervisque omnino immersis, subtus glauco-ferrugineis, epunctatis, nervis gracillimis paulo prominulis; petiolo crassiusculo, canaliculato; racemulis ♀ axillaribus, e basi 3–4-floris, petiolo dimidio brevioribus; drupis globosis, lævibus, piperis magnitudine, stigmate majusculo mammæformi 4-lobo prominente coronatis; nucibus 4.—In sylvis ad Sª Cruz, prov. Rio Grande, et ad ripas fl. Parana, prov. Entrerios.—Bonpland, nos. 2330, 2374, et 2479.

This is certainly a very distinct species, apparently allied to *I. integerrima*, Reiss. It forms a very lofty tree, with a copious rounded head; its leaves are very thick, coriaceous, very smooth, nerveless and polished above, with entire, very rounded and revolute thick margins, cuneate at base, very opake beneath, with inconspicuous nervures; they are 3 inches long, 1⅜–1½ inch broad, on a thick, broad, and somewhat marginated petiole 5 lin. long; the pedicels of the fruit are barely 3 lines long;

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* This plant is represented in Plate 63.

the drupe is 3 lin. diam., with a prominent mammiform and obsoletely 4-lobed stigma. In another specimen the leaves are more polished, extremely smooth above, the margin showing a disposition to become toothed; they are pale brown above and fuscous brown beneath, the petiole being thinner and 3-carinated below*.

4. *Ilex amara,* Bonpl. MSS.;—ramulis rubellis, glaberrimis, striato-angulatis; foliis lanceolatis, imo longe cuneatis, versus apicem cuneatis, et hinc obtusiusculis et emarginatis, ultra medium integerrimis, hinc inde serratis, dentibus extus rotundatis, apice glanduliferis, margine vix revoluto, glaberrimis, crassiusculis, superne nitidis, pallide viridibus, nervis costaque mediana rubella immersis, subtus flavo-opacis, epunctatis, nervis tenuissimis, anastomosantibus, inconspicuis; petiolo flavo, angusto, canaliculato.—In sylvis circa Missiones, ad ripas fluvii Paranensis, et ad montem Santa Cruz in prov. Rio Grande.

This is a still more distinct species, with lanceolate leaves, which are cuneate and entire for two-thirds of their length, their summit being shortly attenuated and emarginated; above, they are opake and very smooth, almost nerveless, with a reddish flat midrib; they are pale green, somewhat paler and yellowish below, where their delicate nervures are scarcely prominent, and their midrib, of an orange-red colour, is not much raised. They are 2¼–2½ inches long, ¾ inch broad, on a petiole 4 lines long. The specimen has neither flower nor fruit. In form the leaves somewhat resemble those of *I. nigropunctata,* but they want the peculiar dotted glands so conspicuous in that species†.

5. *Ilex Humboldtiana,* Bonpl. MSS. (stirps ♂);—Ilex crepitans, *Bonpl. MSS.* (*stirps* ♀);—Ilex Paraguariensis, *Reiss.* (*non St.-Hil.*), *var.* angustifolia, *Flor. Bras.* xxviii. p. 63. tab. 13. fig. 17;—glaberrima, ramulis rugulosis, subangulatis; foliis confertis, lanceolatis, utrinque gradatim attenuatis, summo anguste obtusis, crassiusculis, obsolete dentatis, dentibus glanduliferis, superne nitidis, olivaceo-viridibus vel atrovirentibus, lævissimis, fere enerviis, ad costam profunde sulcatis, subtus flavescentibus aut pallide ferrugineis, nervulis subpatentibus paulo prominulis inter se arcuatim nexis, hinc remote nigro-punctulatis; petiolo tenui, canaliculato; paniculis axillaribus, e basi ramis 3–6, fasciculatis, ramis 3-floris, floribus 4-meris, glaberrimis; drupis parvis, globosis, stigmate mammæformi sub-4-lobo coronatis, nucibus 3–4.—In

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* This species is represented in Plate 64 A.

† A drawing of this species will be seen in Plate 64 B.

montibus Guayaraça et Santa Cruz, versus Rio Pardo, in prov. Rio Grande, et in Missionibus, versus fluv. Paraná, in prov. Corrientes (Bonpland, nos. 2449, 2471, 2332).

The above two species of Bonpland appear to me identical, there being no difference, except that the one is the male plant, with somewhat paler leaves, the other being the female plant, with less elongated and extremely dark leaves. It is evidently one of the varieties of Reisseck's *Ilex Paraguariensis*, but it bears no analogy whatever with the Paraguay type. It is one of the most esteemed kinds of Maté trees, and the tea yielded by it is so strong in flavour as to require tempering by admixture with others of a milder kind. The leaves are very much smaller than any of the preceding species, are attenuated at both ends, above are of a dark green (in the ♀ blackish green), polished, veinless, and deeply channelled at the place of the midrib; beneath, in the ♂, glaucous, in the ♀ of a yellowish hue, opake, owing to a minutely granulated surface, which is remotely spotted with small, immersed, black glands. In the ♂ the leaves are 1½–1¾ inch long, ½ inch broad, on a petiole of 3½ lines; in the ♀ they are 2–2½ inches long, 5–8 lines broad, on a petiole of 2½–3 lines. The flowers are numerous in the axils of the younger branches, in a short fasciculated branching corymb, the basal ramifications being slender, 2½ lines long, each bearing three small flowers on pedicels 2 lines long; the four petals are three times as large as the sepals, orbicular, concave, glabrous, white, the flower expanded being 2 lines in diameter: in the ♂ the sterile ovary is depressed, broadly 8-rayed in the summit, with a small sessile 4-lobed stigma in the centre: in the ♀ the drupe is globular, 1½ line diam., crowned with a prominent mammiform sessile stigma; it encloses three or four nuts *.

6. *Ilex ovalifolia*, Bonpl. MSS.;—Ilex Paraguariensis, *Reiss.* (*non St.-Hil.*) *in Mart. Flor. Bras.* xxviii. p. 63, *var.* longifolia, tab. 13. fig. 16;—Ilex Paraguarensis, *Spach, Phan.* ii. 430. pl. 16;—glaberrima, ramulis angulato-striatis; foliis ellipticis vel elliptico-oblongis, utrinque acutis, apice breviter coarctato et obtuso, coriaceis, rigidulis, glaberrimis, obsolete dentatis, dentibus glandula minuta donatis, margine cartilagineo subreflexo, superne nitidulis, profunde viridibus vel brunnescentibus, nervis immersis vix distinctis, ad costam sulcatis, subtus opacis, pallide glaucis aut flavescentibus, remote nigro-punctulatis, costa valde prominente, nervis subpatentibus inter se arcuatis paulo prominulis; petiolo sulcato,

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* A representation of this plant is shown in Plate 65 A.

sublongiusculo, sæpius recurvo; paniculis axillaribus, multifloris, petiolo 2-plo longioribus, sub lente obsolete puberulis, demum subglabris; floribus 4- rarius 5-meris, petalis oblongis, patentibus; ovario stigmate magno mammæformi 4-lobo sessili apiculato; drupa globosa, stigmate mammillari coronata.—In prov. Rio Grande, ad Faxinal, et versus Rio Pardo (Bonpland, no. 2425) ♀; *ex herb. Delessert*, Rio de Janeiro (cult.?), A. Richard (♂).

This species is very nearly allied to the preceding, and appears to be one of the varieties which Dr. Reisseck has mistaken for the true Paraguay Maté-tree. In the specimen collected near Rio de Janeiro, which seems to be the male plant (appertaining to the female, Bonpland, no. 2425), the leaves are much darker and more polished; they are 1½–1¾ inch long, 8–9 lines broad, on a petiole 3 lines in length: the inflorescence is a branching corymb, 6–9 lines long, with lateral racemose branchlets, each bearing three pedicelled small 4-merous flowers; the sepals and petals have ciliated margins; the sterile ovary has a flat depressed 8-grooved summit, with an obsolete 4-lobed stigma. In Bonpland's female plant the leaves are similar in size and shape, but are much paler above and more glaucous below: its inflorescence is an axillary panicle, 6–12 lines long, with several pedicels, which are either 1- or 3-flowered; if 1-flowered, the pedicel is 2-bracteated below the middle, showing the point where the two abortive flowers would have been inserted: these 1-flowered pedicels are 2–3 lines long; in the 3-flowered ramifications the ultimate pedicels are 1–2 lines long. This female flower is much larger than that of the male, and when expanded is 2 lines in diameter; it is generally 4-, sometimes 5-merous, the sepals and petals having ciliated margins; the ovary is somewhat oval, surmounted by a large, mammiform, sessile, 4-grooved stigma*.

The two following species have been referred by botanists to the true Maté plant:—

7. *Ilex nigropunctata*, nob.;—Ilex Paraguayensis, *var.* γ, *Hook.* (*non St.-Hil.*) *in Lond. Journ. Bot.* i. 35. tab. 3. plant. ♂;—Chomelia amara, *Vell. Flor. Flum.* 42. *Icon.* i. 106. plant. ♀;—ramulis sulcatis; foliis oblongis aut oblongo-lanceolatis, utrinque attenuatis, apice obtusiusculis, obsolete dentatis, dentibus glanduliferis, margine subrevoluto, superne pallide viridibus, nitidiusculis, ad costam sulcatis, utrinque nervosis et reticulato-venosis, subtus (in sicco) flavido- vel glauco-viridibus et nigro-punctulatis, costa prominente; petiolo tenui, canalicu-

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* A drawing of this species is given in Plate 65 B.

lato; racemis axillaribus, multifloris, ternatim compositis, petiolo 2–4-plo longioribus; floribus 4-meris pedicellisque pilosulis; ovario in ♂ depresso, radiatim sulcato, in ♀ ovato; stigmate pulvinato, 4-lobo.—Brasilia, ad Campos de Goitacazes, versus ostium fluv. Parahyba, prov. Rio de Janeiro.—*v. v.* ad Rio de Janeiro, in hort. bot. Imp. cult. (♂ et ♀), et in hort. Kew. Lond. introduct. (♂).—*v. s. in herb. Delessert* (Guillemin, no. 95 ♀).

This has always appeared to me a perfectly distinct species, differing widely in all respects from *Ilex Paraguayensis*, of which it was considered to be a mere variety by Sir Wm. Hooker. I find no species in Reisseck's enumeration of the genus that corresponds with it: he appears, however, to have known this plant only from Sir Wm. Hooker's drawing of it, and he makes it identical with *Ilex affinis*, Gardn. (no. 3086). It is clear to me that, if he had been able to compare these plants with one another, he would have come to a very different conclusion. In the male plant under consideration, the leaves, sometimes alternate, frequently opposite, are lanceolately oblong, pointed towards both extremities, pale on both faces, very reticulated, toothed on the margin at nearly equal distances, the teeth being rounded externally, with an acute gland near the sinus; the under surface of the leaves is spotted all over with very distinct black dots. They are 3¾ inches long, 1⅛ inch broad, on a petiole nearly 4 lines in length. The inflorescence is a simple panicle, ¾–1½ inch long, with alternate secondary pedicels 1½ line long, each surmounted by three pedicellets 1 line long, bearing flowers which before bursting are globular, and 1 line diam.; the flowers are 4-merous, the calyx pubescent, the petals have ciliated margins, the ovary is depressed and radiately sulcate, with a small 4-lobed stigma. In the female plant the leaves are of similar form, but somewhat smaller, fuscous and enervose above, more rigid in texture, the margins more reflexed, and the under surface opake and of a dull yellow colour: the inflorescence is more racemose, bearing 3–5 or 7 flowers, which are somewhat larger and 4-merous; the sepals are small, orbicular, and ciliated, the petals obovate and smooth, the ovary globular, with a small mammiform 4-grooved stigma. Padre Velloz, who has figured the female plant, says it is called *Congonha*, and is used as Maté; but it is more bitter than the ordinary Herva de Curitíba*.

8. *Ilex acutangula*, Neuw. ex Nees in Flor. 1821, p. 329;—Ilex Paraguayensis, *Hook.* (*non St.-Hil.*) *Bot. Mag.* 3992;—Celastrus 4-angulatus, *Schrad. Gött. Anz.* 1821, p. 716; *DC.*

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* The male plant is shown in Plate 66 A, the female plant in Plate 66 B.

Prodr. ii. 7;—ramulis 4-angulatis, rubescentibus; foliis suboppositis, ellipticis, imo subacutis, versus apicem rotundioribus, hinc acumine brevi repente coarctato, recurvatim canaliformibus, irregulariter serratis, dentibus acutis, glanduliferis, supra lucidis, subtus pallidioribus, epunctatis, nervis utrinque paulo prominulis; petiolo brevi, canaliculato; racemis axillaribus, paniculatis; pedicellis plurimis, subumbellatis; calyce pubescente; drupis siccis, sub-8-sulcatis.—Brasilia, *v. v.* in hort. Kew. cult. sub nom. "*Ilex Paraguayensis.*"

This is the species described by Sir Wm. Hooker as the Paraguay Tea-tree, which he figured in the 'Botanical Magazine,' as then growing in Glasgow, where it first flowered in June 1842, having been introduced into this country by Messrs. Luccomb and Pince of Exeter; he again mentioned it in his interesting account of the Maté plant (Lond. Journ. Bot. i. 31). It is distinguished from all the preceding species by its quadrangular stems, its opposite serrated leaves (a character of frequent occurrence in the preceding species), the teeth being very close and regular, and furnished with glandular points which are almost spinous: the recurved and suddenly contracted apex of the leaves affords an additional character. In all its essential features it corresponds with the species above quoted and described in Prince Maximilian Neuwied's 'Travels.' It is certainly allied to the true *Ilex Paraguayensis,* which it resembles in the size of its leaves; but it differs widely in its specific characters: its leaves are less rigid and coriaceous, differently nerved, their margins being closely serrated, the petiole is more terete, and the inflorescence is very different. Both species, having epunctate leaves, belong to the first section of Reisseck's distribution. The leaves are 3½ inches long, 2 inches broad, on a petiole 3 lines in length; their short sharp serratures are 1 or 2 lines distant from one another. I have not seen it in flower, the above floral characters being taken from the figure in the 'Botanical Magazine.' The raceme, as there shown, differs from that of the many preceding species in its primary branches bearing several umbellate pedicels and a cluster of flowers.

The *Ilex truncata* of Prince Neuwied, recorded at the same time, appears to be a closely allied plant: it is the *Celastrus ilicifolius* of Schrader, mentioned in DeCandolle's 'Prodromus,' ii. p. 7.

Allied to these plants is the following species, which I found in the Organ Mountains, and which has been described by Dr. Reisseck under the name of

Ilex ebenacea, Reiss. in Mart. Flor. Bras. fasc. 28. p. 44.

tab. 11. f. 7.—*v. v.* in Montibus Organensibus, prov. Rio de Janeiro.

The description above cited is that of the male plant; but the plant found by me had hermaphrodite flowers and fruit. In this the leaves are alternate, sometimes opposite, rarely ternate, very coriaceous, with immersed nerves, which are scarcely prominent below: the upper surface is convex, sub-polished, with cartilaginous margins, which are very revolute; the midrib is immersed and sulcate above, prominulent below; the lower surface of the leaves is paler and opake, being densely covered with very minute, whitish, punctate scales, seen only under the lens: they want the larger black dots found in the preceding species. The leaves are 2¼–2½ inches long, 10–11 lines broad, on a somewhat slender petiole 6–9 lines long. The inflorescence ☿ is axillary, consisting of 2–5 fasciculated 1-flowered peduncles 2–3 lines long: the calyx is 5-toothed; the five petals are oblong, obtuse, rotately expanded, 3 lines long, 1½ line broad, slightly coalescent at their base by the adhesion of the alternate filaments, which are as long as the petals, and in like manner expanded: the ovary is oval, 5-celled, each cell having one suspended ovule: the stigma is broadly mammiform and sub-5-lobed: the drupe is oval, purplish red, fleshy, 5–7 lines long, 4–6 lines diam., crowned with a large conical stigma, and containing five osseous grooved nuts, each 1-seeded: the embryo is minute, near the summit of the albumen.

It is probable that the *Ilex rivularis*, Gardn., and *I. affinis*, Gardn., both from the province of Goyaz, are theiniferous. Dr. Reisseck considers the one to be a mere variety of the other; but they appear to me sufficiently distinct. In the former the leaves are much broader, stouter, with a more revolute and thicker cartilaginous margin; the nerves are fewer, coarser, more distant and more divaricated; the petiole is shorter and broader. In the latter the racemes are more elongated, more spicated, and the pedicels much longer; the flowers are nearly half the size of the former, with a glabrous (not a pubescent) calyx. These differences cannot be sexual, for in both my specimens the flowers are ♀ and 4-merous.

All the above species, excepting the last-mentioned, are extra-tropical, or scarcely reach the limit of the southern solstice, and they all appear to contain the peculiar principle (*theine*) which exists in Chinese tea and in coffee. The Yerba de Paraguay, like coffee, owes its refreshing qualities not only to the presence of theine, but to a peculiar acid. Dr. Stenhouse found 2 per cent. of theine in Congou tea, and 0·75 to 1 per cent. of the same principle in coffee—called also *caffeine*, both having been found to be identical. The quantity existing in the Yerba de Paraguay has not been ascertained, but it is probably not less in amount than in coffee. Coffee, however, derives its pleasant flavour principally from its peculiar acid, called caffeic acid, which is very analogous to kinic acid, or the vegetable acid of Cinchona-barks. Dr. Stenhouse relates that when caffeic acid is treated with sulphuric acid and binoxide of manganese, it yields the peculiar principle called *kinone*, and that the Paraguay tea also furnishes kinone when subjected to a similar treatment. It is worthy of notice that the leaves of our common Holly, when exposed to the action of the same reagents, also yield kinone, as do the whole of the Cinchona tribe of plants and Asiatic Tea. There is another vegetable product of an analogous nature, the *guaraná*, or inspissated juice of the *Paullinia sorbilis*, prepared by the Indians of Pará, the infusion of which affords a very refreshing drink, of which the Indians are very fond. This has been analysed by Dr. Stenhouse, and found to contain a large proportion of theine. It is singular that Man, in the lowest grades of civilization, should have had the faculty of distinguishing and applying to his use those plants which contain the peculiar principle to which the tea of China owes its invigorating property.

ON VILLARESIA.

THIS genus of the Flora Peruviana is but little known, only one species having been yet described. Poiret (in 1808) considered it to belong to *Aurantiaceæ*,—an idea derived, no doubt, from the vernacular name of the typical species, "*Naranjillo*." Jussieu (in 1821) gave a very correct description of that species, accompanied by analytical figures (Ann. Sc. Nat. xxv. tab. 3), and placed the genus rightly in *Aquifoliaceæ*. Don (in 1832) described the same plant under the name of *Citronella mucronata*, when he assigned it a position near *Cassine*. Hooker and Arnott (in 1834), in their enumeration of Chile plants (Hook. Journ. Bot. i. 283), arranged the genus next to *Myrsine*. Jussieu states that some botanists had considered it as belonging to *Menispermaceæ*; and Dr. Lindley (in 1836) appears to have then adopted similar conclusions in referring it to *Schizandraceæ* (Introd. Bot. 553), but afterwards (in 1846) he retracted this opinion (Veg. Kingd. 598), and, following the view of Jussieu, placed it in *Aquifoliaceæ*. Endlicher pursued the same arrangement in his 'Gen. Plant.' No. 5709.

On a former occasion, I adduced abundant evidence to show that the *Icacinaceæ* do not belong to *Olacaceæ*, and that the proper place of that family in the system is near the *Aquifoliaceæ*, the structure in both cases being nearly similar, differing principally in the æstivation of the corolla, which is valvate in the former and imbricate in the latter. In both families the ovarium is normally plurilocular; and when, as in *Villaresia*, it is one-celled, this is always due to the abortion of the other cells—a condition that also prevails throughout the *Icacinaceæ*; it therefore very rarely happens that more than one cell and a single seed are perfected in this genus. I have recorded the fact* that in *Pennantia*, where the fruit is generally unilocular and monospermous, it sometimes occurs that two cells, each 1-seeded, are developed. I have witnessed the same exceptional occurrence in *Villaresia*, in a species growing at Kew, where, on the same plant, some of the ovaries were 1-locular, while others were distinctly bilocular, each with two ovules collaterally suspended from the dissepiment. Hence the rule is general throughout both families, that, although the normal condition of the ovary is plurilocular, there exists a general tendency to the abortion of most of its cells. Thus in *Ilex* we have constantly four, or more rarely five, cells, in *Prinos* six to eight, in *Cassine* three, in *Nemopanthes* three or four, while in *Byronia* they number from twelve to sixteen; in *Villaresia* it is almost universally 1-celled, as also is the case in *Æxtoxicum*, which appears to belong to the same family. Although, as I have mentioned, the ovary in the *Icacinaceæ* is generally unilocular, it is constantly 3- or 5-celled in *Emmotum*.

Throughout both families there is a general tendency towards the suppression of one of the sexes, so that the flowers are always more or less polygamous; and this is carried to such an extreme in *Æxtoxicum*, that they are constantly diœcious, when in all other respects the structure corresponds with the *Aquifoliaceæ*. On the other hand, perhaps no genus in the family approaches nearer to regular hermaphroditism than *Villaresia*.

One great peculiarity attends the development of the ovary in this genus: the suppressed cells united in the normal axis form a prominent longitudinal parietal expansion, which extends far towards the centre of the single fertile cell; and from near the summit of this expansion the two collateral ovules are suspended. In the fruit, only one of these ovules arrives at maturity, and that soon fills the entire cavity; the seed therefore moulds itself about the placental expansion, becoming thus bent round it, so that its transverse section is hippocrepiform. A similar structure occurs in *Bursinopetalum*, as is well shown by Dr. Wight, in his 'Icones' (tab. 956). This latter genus is referred by Dr.

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* Huj. op. vol. i. p. 77, pl. 12. figs. 25–28; Ann. Nat. Hist. ser. 2. vol. ix. p. 488.

Wight to *Olacaceæ,* but it cannot belong to that family, on account of the structure of its ovary and the mode of suspension of its ovules, in which respects there is a perfect analogy to the structure of *Villaresia.*

I will shortly detail the observations I have recently made on the peculiar structure of *Bursinopetalum,* and will endeavour to indicate its real affinity.

Although, as before stated, the æstivation of the petals in *Villaresia* is broadly imbricative, their summits are always inflected and folded into each other, so that it is sometimes difficult to unravel a bud. This occurs also in *Bursinopetalum* and in other genera of the family, as in the male flowers of *Ærtoxicum,* for example. The greater or less degree of inflection of the summits of the petals is nearly universal in the *Icacinaceæ,* and this occurs sometimes to a great extent; but as the æstivation there is completely valvate, the separation of the parts in the bud is quite easy.

Another peculiarity exists in *Villaresia*—the presence of hollow glands imbedded in the parenchyma of its leaves, each with a pervious opening on the lower face, always situated within the axils of the primary nerves or in the sinus of their first bifurcations: this peculiarity is not confined to the typical species in which I first observed it. Ruiz and Pavon notice the occurrence, which they attribute to the work of insects; but this is not probable, because these porous glands present themselves regularly in the axils, exactly in the same position, and appear as constantly in the several Brazilian species as in those of Chilian growth. Sometimes the base of the nerve, where it joins the midrib, is expanded like a lamellar plate, forming a hollow pouch beneath it, with the porous aperture in its mouth; generally the hollow within the parenchyma is not much larger than the open pore itself.

Villaresia was considered to be a genus peculiar to Chile, but it has since been found in the Banda Oriental and in Southern Brazil, and even within the tropics as far as 15° S. lat. These Brazilian plants have all been considered by Reisseck as identical with the type of Chilian growth; but the characters here given show them to be specifically distinct. In habit they all much resemble those of *Ilex,* the leaves in some species of both genera being often spinoso-dentate; in others they are quite entire. It is probable that they contain *theine,* as in *Ilex Paraguayensis* and other species of that genus; for the leaves of the *Ilex Congonha* of Martius, which is a species of *Villaresia,* are used in Brazil as tea, the Brazilian term *congonha* being synonymous with the word *yerba,* as the tea of Paraguay is called. It may sometimes be difficult to distinguish the plants of *Villaresia* from those of *Ilex;* but a ready test is always to be observed in the flower, the pistil in the former genus being furnished with a lengthened style, while in the latter the stigma is always quite sessile: the fruit of the one can never be confounded with that of the other. Many of the Brazilian species have much larger and thinner leaves, and the inflorescence is frequently terminal in subfasciculated spikes: they bear much the appearance of *Leretia,* a Brazilian genus of the *Icacinaceæ*—a family differing chiefly from the *Aquifoliaceæ* in the æstivation of the corolla and the mode of development of the fruit. In the before-mentioned species of *Villaresia* growing at Kew, where some of its flowers had a 2-celled ovary, with two ovules in each cell, suspended from the summit of the dissepiment, I found that, in this case, it had two styles.

All the species belonging to the genus form erect trees having straight trunks, with copious frondose heads; but Prof. Reisseck states, in his generic diagnosis (in Mart. Flor. Bras. fasc. xxviii. p. 75), that the plants are sometimes scandent. From this it may be inferred that he alludes to the *Villaresia scandens* of Hasskarl; but that plant (from Java) cannot belong to the genus, nor even to the same family[*].

The following emended generic characters are founded on my own observations, except those of the fruit and seed, which are copied from the description of Jussieu.

VILLARESIA, R. & P.;—Citronella, *Don;*—*Flores* hermaphroditi vel rarius polygami. *Sepala* 5, acuta, imo connata, æstivatione imbricata, persistentia. *Petala* 5, libera, sepalis alterna, oblonga, nervo mediano prominulo intus instructa, margine tenui, undulato-crenata, æstivatione quincuncialiter imbricata, apicibus valde introflexis et inter se complicatis. *Stamina* 5, cum petalis alternantia, et iis paulo breviora; *filamenta* complanato-subulata; *antheræ* introrsæ, cordato-reniformes, 2-loculares, longitudinaliter dehiscentes. *Ovarium* sessile, conicum, sæpius subgibbum et 1-loculare, intus carina parietali (e loculis abortivis in axem centralem congestis) valde prominente no-

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[*] In Retzia, i. 152; Walp. Ann. iv. 431: it differs from *Villaresia* in its scandent habit, its 2-locular ovarium with only a single pendent ovule in each cell, and its exalbuminous seed with large fleshy cotyledons. On this account it seems more likely to be allied to *Chailletia,* with which it appears to agree in the structure of its flower and fruit. I know the plant only from description: from its glabrous leaves, white corymbose flowers, which are free, and not connate with the petiole, its entire petals, and simple long glabrous style, it is perhaps near to, if not identical with, *Chailletia* (*Dichapetalum*) *Timoriensis,* DC., with which it also agrees in its geographical position. The *Chailletia dichapetalum,* R. Br., from Madagascar, is scandent.

tatum, *ovulis* 2 collateralibus a summo carinæ suspensis; vel rarius complete 2-loculare et *ovulis* 2 collateralibus in quoque loculo ad apicem dissepimenti affixis. *Stylus* brevis, crassiusculus, in ovario uniloculari unicus, sublateralis; in ovario 2-loculari styli 2; *stigma* obliquum, obtusum. *Drupa* globosa, parce carnosa, endocarpio lignoso semisepto longitudinali superne latiore, incomplete 2-loculata, abortu monosperma. *Semen* cavitati loculi conforme, hinc circa semiseptum longitudinaliter plicatum; *integumenta* dupla, tenuia, interius in rimulas albuminis immissum; *embryo* intra *albumen* copiosum carnosum apicem versus nidulans, parvus; *radicula* supera, teres, *cotyledonibus* complanatis orbiculatis duplo longior.

Arbores vel arbusculæ *Chilenses et Brasilienses, sempervirentes*; folia *alterna vel subopposita, elliptica, integra, vel spinoso-dentata, sæpe rigide coriacea, glaberrima, petiolata*; inflorescentia *axillaris vel terminalis, sæpius spicatim racemosa*; flores *albi, parvuli, citriodori.*

1. *Villaresia mucronata*, R. & P., Flor. Per. et Chil. iii. 9, tab. 231; A. Juss. Ann. Sc. Nat. xxv. 14, tab. 3. fig. 2; Gay, Chile, ii. 12; Reiss. in Mart. Flor. Bras. fasc. xxviii. p. 75 (in parte);—Citronella mucronata, *D. Don, Edinb. Phil. Journ.* xiii. 243;—Citrus Chilensis, *Molina*;—ramulis flavidis, opacis, striatulis; foliis ovato-oblongis, apice longe mucronatis, utrinque acutis, interdum imo obtusioribus, coriaceis, margine cartilagineo integris vel rarius subsinuato-dentatis et obsolete spinosis, supra lucidis, læte viridibus, subtus pallidioribus, opacis, costa mediana prominente; nervis anastomosantibus venisque reticulatis utrinque prominulis, subtus in axillis et in dichotomiis nervorum glandula cava immersa poro aperto donatis; petiolo brevi, rugoso, sub lente puberulo; paniculis terminalibus, folio multo longioribus, spicatim racemosis; rachi flavida, tomentella, ramis 3-floris patentibus calycibusque pubescentibus; petalis flavido-albis, glabris, odoratissimis; drupa olivæformi.—Chile, *v. v.*, in provinciis centralibus *Naranjillo* dicta, in australioribus *Guilli-patagua* nuncupata.

A tree growing in the central provinces of Chile, and extending as far to the southward as 35° lat.: it grows to the height of 10–20 feet. In the Viceroy's report to the King of Spain, enumerating the useful trees and shrubs of Chile, the *Naranjillo* of Aconcagua is said to be 50 or 60 feet high, and of sufficient girth to furnish logs 18 inches square and 21 feet in length. I have never seen or heard of its attaining any approach to that size. It has an erect trunk, with a broad spreading head and copious foliage. The wood is white and tough, with a fine grain, and is easily worked; when sawn, it makes good

barrel-staves. The leaves are thick and rigid, of a pale, bright, shining green, generally elliptic and acute at both extremities, with a sharp mucronate apex, a thick yellowish cartilaginous border, which is generally entire, rarely obsoletely spinose, 1½–2½ inches long, ¾–1 inch broad, on a fleshy thickened petiole 2 lines long. The terminal inflorescence is a spicated raceme, ferruginously pubescent, 3 or 4 inches long, its numerous alternate branchlets, bracteated at base, being very patent, and 4–6 lines long, each bearing at its apex 3–6 almost sessile flowers; the sepals are suborbicular, pilose, with ciliate imbricated margins, ½ line diam.; the petals are oblong, 2 lines long, 1 line broad, cuneate at base, internally furnished with a raised carinated nervure, the margins crenated, broadly and quincuncially imbricated in æstivation, the summits of the three more internal ones being inflected and plicated together; the stamens are about two-thirds the length of the petals; the ovary and short style are the length of the stamens, and glabrous. The fruit, which I have not seen, is said to be 6–8 lines long and 4–5 lines in diameter*.

Var. *læta*;—foliis late ovatis vel obovatis, e basi 3–5-nerviis hinc obtusis, rotundatis aut subcordatis, apice breviter et acute mucronatis, margine cartilagineo sæpius obsolete dentato-spinosis, rigidulis, supra nitentibus et pallide viridibus, subtus opacis et flavescentibus, costa mediana superne paulo, subtus valde prominente, hinc in axillis nervorum poroso-glandulosis; petiolo brevi, lato, superne profunde canaliculato, in junioribus puberulo; racemis terminalibus, sæpe duplis, folio brevioribus, floribus dense agglomeratis, ramis brevissimis, puberulis, imo bracteatis, apice 2-floris; floribus sessilibus, ebracteatis.—*v. v.* ad Limache; *v. s. in herb. Mus. Par.*, Rancagua, *in herb. Hook.*, Valparaiso (Cuming, 556), Colchagua (Bridges).—An species distincta?

This variety is very distinct, in its constantly broader, larger, and more rounded leaves, the margin being often obsoletely spinose; the inflorescence is much shorter, and the flowers are more aggregated; the leaves are 2–2½ inches long, 1¼–1½ inch broad, on a petiole 1–2 lines long; the inflorescence is usually ¾ inch, seldom 2 inches long; the alternate branchlets, being less than a line in length, bear one or two flowers†.

2. *Villaresia pungens*, n. sp.;—ramulis teretibus, pallide glaucis, subpuberulis; foliis glaberrimis, obovatis, basi rotundis et

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* A figure of this plant, with analytical details, is given in Plate 67 A.

† This variety, with analytical details, is represented in Plate 67 B.

subcordatis, apice acutis et aciculato-mucronatis, margine cartilagineo undulato-crispatis et crebre aciculato-spinosis, supra nitentibus læte viridibus, subtus pallidioribus, utrinque reticulatis, subtus nervis arcuatis costaque prominentibus, glandulis porosis nullis, aut raris in axillis nervorum; petiolo brevissimo, supra complanato, subtus convexo, et transversim ruguloso.—Concepcion, *v. s. in herb. Hook. et Mus. Brit.* (Cuming), *sine flore.*

This plant differs from the typical species in its larger leaves, which are nearly sessile, very broad and subcordate at base, less coriaceous, very shining, the margin being very crispately undulated, and armed at the distance of 1 or 2 lines with very sharp patent spines 1 line long; the poriferous glands are generally wanting, or, if present, are much smaller, and seldom in the axils of the nervures. The leaves are 2½–3½ inches long, 1½–2½ broad, on a petiole 1 line long and 1 line broad*.

3. *Villaresia Congonha,* nob.;—Villaresia mucronata, *Reiss.* (*non R.& P.*) *in Mart. Flor. Bras.* fasc. xxviii. p.75, tab.22 et tab.14. fig. 18;—Ilex Gongonha, *Mart. Reiss.* (*edit. Angl.* ii. 100); *Lambert. Pin.* ii. *Append.* tab. 6; *G. Don. Dict.* ii. 18;—Cassine Congonha, *Mart. Isis.* 1824, p. 589; *St. Hil. in Guillem. Arch. Bot.* i. 31; *Spreng. Syst.* i. 939;—Myginda Congonha, *DC. Prodr.* ii. 13; *G. Don, Dict.* ii. 16;—ramulis foliis oblongo-ovatis, imo acutis, apice obtusioribus et valde mucronatis, margine crassiusculo cartilagineo reflexo, rarius integro, sæpissime breviter et remote sinuato-spinosis, coriaceis, utrinque subopacis, pallide viridibus, concoloribus, supra reticulatis, subtus costa, nervis tenuibus venisque paulo prominulis, et hinc vesicula immersa poro aperta in axillis omnibus nervorum donatis, petiolo subbrevi, canaliculato; racemis axillaribus et terminalibus, subspicatis, bracteatis, flavido-pilosis; ramis brevissimis, 3-floris, floribus parviusculis, sessilibus, bracteolatis, ramis basalibus iterum ramosis; sepalis parvis, rotundato-acutis, ciliatis; petalis oblongo-linearibus, subspathulatis, suberectis, cucullatis; staminibus brevissimis, sepalis vix longioribus; ovario glabro, ventre 2-sulcato.—Brasilia, in prov. australioribus et centralibus, *v. s. in herb. Hook.*; Rio Grande et Entre Rios (Tweedie).

This plant is considered by Dr. Reisseck to be identical with the typical species, of Chilian growth: it certainly resembles it in general appearance, but has several distinctly characteristic features. The leaves are differently shaped, and not so shining above; the racemes are usually axillary, and much shorter; the flowers only half the size; the petals are more linear, and the stamens proportionally shorter. In Tweedie's specimens, the leaves are 1¾ inch long, 1 inch broad, on a petiole 1½ line long; in the drawing given in Lambert's work, of a plant from the province of Minas Geraës, which I have not seen, and which is probably a distinct species, the leaves are 4–4½ inches long, 2½ inches broad, on a petiole 3–4 lines long. In both, the racemes do not exceed a length of 9 lines, and are often shorter; their lateral branchlets are 1–2 lines long, bearing on their summits a cluster of three to six extremely small sessile flowers; the sepals are ¼ the length of the petals, and are seated on a 5-lobed hispid torus: the petals are little more than ½ line long, and ⅛ line in breadth; they are erect (not expanded as in *V. mucronata*); in æstivation their summits are more deeply inflected: the stamens are ⅕ the length of the petals; the ovary and style ¾ of their length. The ovary is glabrous, gibbous on the dorsal side, 2-sulcate on the ventral face, the style being somewhat excentrical, and with a clavate stigma*.

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* A representation of this plant is given in Plate 68.

4. *Villaresia cuspidata*, n. sp.;—Villaresia mucronata, *Reiss. in parte* (*non R. & P.*);—ramulis angularibus, flavido-opacis, foliis ovatis vel ellipticis, utrinque acutis, apice mucrone longo valido cuspidatis aut retusis, crasso-coriaceis, margine cartilagineo integro crasso reflexo, supra nitidis, pallidiusculis, reticulato-venosis, nervis immersis leviter sulcatis, subtus valde flavido-opacis, minute nigro-punctulatis, costa, nervis arcuatis venisque prominentibus, rarius in axillis nervorum glandula porifera donatis, longe petiolatis; petiolo flavido-opaco, subruguloso, superne profunde canaliculato; racemis axillaribus et terminalibus 3–4, fasciculatis, folio tertia parte brevioribus, subspicatis; brachiis patentibus, imo bracteatis, summo flores 3 sessiles bracteolatos gerentibus; rachi brachiisque flavido-puberulis.—Prov. Minas Geraës, *v. s. in herb. meo*; Salgado, ad Rio San Francisco.

This species differs from the preceding in having still thicker leaves, which are quite entire, nigro-punctulate beneath, and rarely with poriferous glands in the axils of the nerves; the petiole is three or four times the length of that of the former. The leaves are 2–2¾ inches long, 1¼–2¼ inches broad, on a petiole 5 or 6 lines in length. The racemes are 9–12 lines long, the lateral branchlets 1 line long. The flowers are much smaller than in *V. mucronata*, being about 1½ line in diameter when expanded; the minute sepals are nearly glabrous, membranous, with ciliate margins, concave, suborbicular, acute at the apex, and imbricated; they are adnate upon an externally pilose deeply 5-lobed fleshy torus: the petals are elliptic, with an internal carinated nervure, three times longer than the sepals; the stamens are two-thirds the length of the petals, and as long as the ovary and style, which are quite glabrous*.

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* This species is shown in Plate 69.

5. *Villaresia megaphylla*, n. sp.;—ramis angulatis, striatis, opacis; foliis majusculis, oblongis, imo acutis, summum versus breviter attenuatis, acumine calloso, integerrimis, margine undulato, submembranaceis, glaberrimis, nervo marginali tenuissimo revoluto nitido, supra pallide viridibus, opacis, costa mediana immersa et sulcata, inferne prominente et striata, nervis tenuissimis venisque haud reticulatis utrinque vix prominulis et eglandulosis, impunctatis; petiolo longiusculo, subtenui, semitereti, supra canaliculato, imo articulato; paniculis axillaribus et terminalibus, paulo supra basin brachia 5–8 arcte approximata et fere fasciculata emittentibus, divaricatis, folio dimidio vel triente brevioribus, spicatim racemosis; ramis remotiusculis, brevibus, patentibus, imo bracteatis, apice flores parvos 3–5 sessiles bracteolatos gerentibus; sepalis parvis bracteolisque puberulis; petalis oblongis, glabris, et staminibus æquilongis; ovario dense albido-piloso, uniloculari; stylo subexcentrico, breviusculo, glabro.—Prov. Rio de Janeiro, *v. v.* circa Freichal, ad pedem montium Organensium.

This and the following species are very dissimilar in appearance to any of the preceding, bearing somewhat a resemblance to the genus *Leretia*; but their floral structure is quite in accordance with *Villaresia*, and some have the same porous glands in the axils of the nervures that characterize the genus. The leaves are 7½ inches long, 3¼ inches broad, on a petiole 10 lines long: the radiating divisions of the inflorescence, in my specimen, are 2 inches long; but as they are in a young state, they probably would be double that length when fully matured; the lateral branchlets are 1 line long, quite patent, and bear three or five sessile flowers at their apex: the flower expanded is 2½ lines in diameter; the sepals are obovate, somewhat acute, imbricate, and pilose; the petals are lanceolate-oblong, nearly three times as long as the sepals, with a prominent internal keel; they are imbricated in æstivation, with their apices inflected: the stamens are three-fourths the length of the petals, and longer than the pistil: the ovary is obovate and pilose, 1-celled, with two suspended ovules†.

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* A drawing of this plant is given in Plate 70.

† This species, with analytical details, may be seen in Plate 71.

Var. *acuminata*;—foliis longius acuminatis, paniculæ brachiis folio fere æquilongis, ramis remotioribus et paulo longioribus, floribus majoribus, ovario interdum 2-loculari cum stylis 2. —*v. v.* in hort. bot. Kew. cult.

The differences above mentioned may only be the result of culture; but I think the plant must be referred to the species above described, which I found at Freichal. The leaves in this cultivated variety are 6½–7¼ inches long, 2¾–3 inches broad, on a petiole of 5 or 6 lines; the radiating branches of the inflorescence are 2–6 inches long, the main stems nearly glabrous; the lateral branchlets alternate, ¼–½ inch apart, and quite patent, are 2–3 lines long, and pubescent: the flowers expanded are 3 lines in diameter.

6. *Villaresia virescens*, n. sp.;—glaberrima, ramulis teretibus, vix striatulis; foliis ellipticis vel oblongis, utrinque acutis, apice acuminatis, integerrimis, submembranaceis, margine cartilagineo nitido reflexo, obscure viridibus, opacis, subtus pallidioribus; nervis tenuibus venisque vix prominulis, eglandulosis et epunctatis, breviter petiolatis: paniculis racemoso-spicatis, simplicibus, axillaribus et terminalibus, breviusculis; floribus sessilibus in apice ramorum brevissimorum glomerulatis; sepalis pilosis; petalis glabris, intus carinatis; ovario glabro; stylo brevi, subexcentrico; stigmate clavato, subbilobo.—Prov. Rio de Janeiro; *v. s. in herb. meo*, Iguassa, ad pedem montis Serra de Tingoá.

A species analogous to the last mentioned, with smaller leaves, acute at both extremities, with much shorter petioles. The leaves are 4½–5 inches long, 1¾–2 inches broad, on a petiole 3 lines in length. The inflorescence consists of a short simple panicle, in which the lateral branches are so short and approximated that the whole bears the appearance of a spike of agglomerated flowers: the sessile flowers are nearly 2 lines in diameter; the sepals are oblong, membranaceous, obtuse, and slightly pubescent; the petals are 1 line in length and three times as long as the sepals, they are smooth, carinate within; the stamens are nearly equal to them in length, and as long as the pistil; the ovary is almost glabrous.

7. *Villaresia ramiflora*, n. sp.;—glaberrima, dichotome ramosa, ramulis striato-angulatis; foliis lanceolato-oblongis, vel ellipticis, imo cuneatis, apice longiuscule sensim acuminatis, acumine obtusiusculo calloso, integerrimis, margine cartilagineo rubello nitido revoluto, supra viridibus subopacis, costa nervisque immersis sulcatis, subtus ferrugineo-pallidis, costa striata, nervis tenuibus venisque subprominulis, cavitate porosa

versus axillas nervorum, aliisque minutis vagis; petiolo subtenui profunde canaliculato: panicula ramosa, terminali, petiolo 3-plo longiore; floribus parvulis, sessilibus in ramis subglomerulato-spicatis; sepalis villosis; petalis ovatis, paulo acutis, intus carinatis, sepalis 2-plo longioribus; staminibus, sepalis pistilloque æquilongis; ovario glabro, vel pilis paucis in sulco ventrali munito; stylo brevi; stigmate clavato.—In montibus Organensibus prov. Rio de Janeiro, *v. v.*

This species is near *V. megaphylla*, but has many distinct features. Its leaves are 4–5 inches long, 1¾–2 inches broad, on a petiole 4–5 lines long. The panicle is little more than an inch long; it has several alternate branches, 4–6 lines long, the lateral branchlets being extremely short or almost obsolete, each bearing three sessile flowers in its apex, which make the branches appear glomerate-spicate; the flowers expanded are smaller than any of the preceding.

8. *Villaresia paniculata*, nob.;—Leonia paniculata, *Mart. hb. Bras.* No. 420; *DC. Prodr.* viii. 669 (*in adnot.*);—Leretia paniculata, *Mart. Flor. Bras.* fasc. xvii. p. 17 *in not.*;—foliis oblongis, basi attenuatis, apice obtusis vel acutis, coriaceis; nervis tertiariis vix distinctis; paniculis terminalibus, contractis, folio brevioribus; drupa oblonga, 1-sperma.—In sylvis prov. Rio de Janeiro.

I have not seen this plant, which evidently is very closely allied to, if not identical with, one of the three last-named species. The size of the leaves is not given by DeCandolle, nor the characters of the flower; but its fruit and seed are completely those of *V. mucronata*. The calyx is said to be 5-partite, with puberulous ovate sepals; the drupe oblong and 1-seeded, the seed being plicated round the prominent longitudinal indurated placenta, which is enlarged by other two abortive cells, and projects far into the cavity of the fertile cell, the seed being suspended from its summit. The specimen, being fructiferous, appears to have had no flowers, as Prof. DeCandolle says of it, "flore ignoto."

ÆXTOXICUM.

THE position of this genus of the Flora Peruviana has not yet been satisfactorily established; but the observations I have been enabled to make will probably throw some light on the subject. The only botanist who has suggested a place for it is Sir Wm. Hooker, who, in 1837, referred it to *Euphorbiaceæ*; but the structure of the fruit and seed, with other characters, militate against this conclusion. Notwithstanding the anomaly of some of its features, the weight of the evidence here collected together will, I think, show its close proximity to the *Aquifoliaceæ*. The distinguished botanist just mentioned, when he described its flowers as being diœcious, had only seen the male plant; they are, however, properly speaking, polygamo-diœcious: that is to say, in the male flowers the ovary, though present, is rudimentary and sterile; and in the female flower, although the stamens of the usual size exist, the anther-cells are abortive and deficient of pollen: the two sexes are always in distinct plants, and in all these respects the genus resembles *Prinos* and *Nemopanthes*: so far, therefore, *Æxtoxicum* is quite reconcileable with the *Aquifoliaceæ*. Its only known species is a native of the central and southern provinces of Chile, where it forms an evergreen tree of some height, with oblong alternate leaves, covered with lepidote scales. Its flowers are small, in simple axillary racemes much shorter than the leaves, the whole inflorescence being densely covered with lepidote scales similar to those of the leaves. Each flower, while in bud, is closely invested by a membranaceous entire spherical bract, which bursts by laceration from the base, and falls off to allow of the expansion of the floral parts: we find no other genus in the family possessed of this character. The calyx consists of five (rarely six) orbicular concave membranaceous sepals, which are much imbricated in æstivation, and are formed of close rows of longitudinal cells, all radiating towards the circumference from the point of attachment; and they therefore easily split in that direction. The petals, always equal in number to the sepals, are alternate with them; they are longer, obovate, narrowed towards the base, with an internal raised keel and undulating crispate margins; in the female plant they are quincuncially imbricated in æstivation; in the male flower the three internal petals have their apices much inflected and plicated together,—in all which respects they closely resemble those of *Villaresia*. The stamens, in both sexes, usually five (rarely six), alternate with the petals and with as many fleshy glandular processes, all being hypogynous around the ovary. Whenever the flower is abnormally 6-merous, the sixth sepal, petal, stamen, and gland are always smaller, sometimes almost rudimentary; and in all cases these are forced out of the concentric serial lines by crowding, so that the perfect symmetry of the parts becomes thus somewhat deranged, showing the normal structure to be 5-merous, and that it only becomes 6-merous by a kind of monstrous growth. In order to ascertain the nature of the glandular processes, it is necessary to particularize their structure. They are described by Sir Wm. Hooker as a nectary,—a term too ambiguous in its meaning; they appear to me sterile stamens, or staminodes; for they alternate with the filaments, and seem to stand in the same whorl; they are somewhat deltoid in form in the ♂, tapering downward to the point of their attachment round the base of the small central sterile ovary, are almost unequally 2-lipped and slightly concave at the summit, each lip being emarginated; from their form, they appear somewhat radiately expanded, and, as well as the stamens, are quite glabrous, leaving in the centre the depressed disk-shaped ovary, which is covered with lepidote scales, similar to those which invest the bract and leaves. These staminodes, in the ♀ flower, are more compressed, simply 2-lobed in the summit, and, like the stamens, stand erect, pressed against the ovary; they cannot be considered as the lobes of a disk, because they are perfectly free and hypogynously attached, alternating with the stamens round the base of the ovary.

The filaments in the ♂ flowers are semiterete, thick, and fleshy, divaricating outwards at the point of their hypogynous attachment, but gradually curve inwards, so that the anthers meet in a connate form in the centre: the anthers are nearly globular, and, consisting of two adnate lobes, are cordate at the base, where they are somewhat dorsally affixed to the pointed apex of the filament; the lobes burst somewhat laterally, each by a longitudinal fissure, the margins of which contract, so that each appears to open by a large broad pore; they are nearly the length of the filament, the entire stamens being twice as long as the intermediate staminodes, the same length as the sepals, and two-thirds the length of the petals. Sir Wm. Hooker's figures of the parts of the male flower are very correctly depicted.

In the female flower, the bract, sepals, and petals are similar to the same parts in the male; but the petals in the bud are pressed imbricatively upon the ovary, which fills all the space in the centre. The five filaments are linear, half the length of the ovary, against which they stand erect, are much compressed and rendered somewhat emarginate at the summit by the presence internally of two small yellow glands, which are the abortive anthers: the five alternate staminodes are rather more than half their length, nearly double their breadth, emarginate at the summit, equally compressed and erect, and stand in the same whorl hypogynously attached round the base of the ovary: they are all quite smooth; but the ovary is densely covered with imbricated peltate lepidote scales, entirely concealing the style, which is suddenly bent down and adpressed upon it: when the flower bursts, the style raises itself out of its imprisonment and remains still considerably reflexed; it is smooth, terete, and about one-third the length of the ovary, being terminated by a somewhat compressed 2-furcate stigma, the forks of which are rather acute. The ovary is 1-celled, with two ovules suspended from near the summit, affixed by a small point to the apex of an internal longitudinal ridge, nearly as in *Villaresia*, which ridge is probably formed of four abortive cells. This becomes developed into an oval dry drupe, about 5 lines long and 3 lines in diameter, consisting of a somewhat chartaceous indehiscent 1-celled putamen, marked internally and externally by the line indicating the suppressed axis, from the summit of which two seeds are suspended, filling the cavity of the cell: each seed is therefore oval and plano-convex; its integuments are membranaceous, with a small basal chalaza: the enclosed nucleus is a fleshy albumen, imbedding in its summit an embryo of half its length, with cordiform, broadly ovate, acute, foliaceous cotyledons, and a terete subulate radicle, equal to them in length, with its thicker extremity nearly touching the superior hilar point of attachment of the seed.

There may be seen in all these details the very closest resemblance to the structure of *Villaresia*, the chief points of dissidence being the presence of the singular floral bract and of the five staminodes. To the former, little importance can be attached in an ordinal point of view. This organ is very analogous to the involucral calycule of the *Chamælaucieæ*, and, like it, breaks away from the base to allow of the opening of the flower. With respect to the nectarial glands, they must be regarded either as portions of a disk, or (as just assumed) as sterile stamens (staminodes); we cannot admit the first hypothesis, because these processes do not support the ovary, but are quite free, hypogynous, and alternate with the stamens in the same whorl: the natural conclusion, therefore, is that they are metamorphosed abortive stamens, or *staminodia*. We must bear in mind that, throughout the *Aquifoliaceæ*, there is a general tendency to the suppression or depauperation of some of the floral parts, by which the flower becomes more or less polygamo-diœcious. To this reasoning it may be objected that hitherto the rule has been universal in the *Aquifoliaceæ* for the stamens to be equal in number to the petals; but many other families could be adduced where, although such is the prevailing rule, exceptions (solitary or few) occur, where the number is double; the occasional existence of a set of staminodes, in addition to the usual number of stamens, is not unfrequent in families remarkable for their isomerous proportions; and under this point of view we may be justified in admitting *Æxtoxicum* within the limits of the *Aquifoliaceæ*. But if it be thought desirable in order to preserve the consistency of the family, this genus might form the type of a distinct subtribe (*Æxtoxiceæ*) distinguished from the tribe *Ilicineæ* by the peculiarities before described. In support of this view we may add that *Chailletia* has similarly-shaped staminodes, placed in like manner in the same whorl alternately with the stamens. Similar processes appear to exist in *Siphonodon*, Griff., a genus referred to *Aquifoliaceæ*.

From the analytical details before given, I now offer the following amended generic character :—

ÆXTOXICUM, R. & P.—*Flores* dioico-polygami. *Masc.* in diversa planta. *Bracteola* membranacea, in calyptram undique clausam cum pedicello continuam florem involucrans, dense lepidota, e basi demum irregulariter rupta, et hoc modo decidua. *Sepala* 5 (rarissime 6), orbicularia, concava, membranacea, glaberrima, in æstivatione valde imbricata. *Petala* 5 (rarissime 6), spathulato-oblonga, apice obtusa, imo angustiora, intus carina longitudinali prominente extusque nervo instructa, margine crenulato-crispata, æstivatione quincuncialiter imbricata, apicibus introflexis et inter se plicatis. *Stamina* 5 (rarissime cum sexto rudimentario), petalis alterna et breviora, introrsa; *filamenta* semiteretia, incurva, carnosula, circa ovarium sterile depressum inserta: *antheræ* conniventes, subglobosæ, basi cordatæ, dorso affixæ, 2-lobæ, lobis adjunctis, subcoriaceis, utrinque rima obliqua demum poriformi lateraliter dehiscentibus. *Staminodia* 5 (rarissime 6), staminibus alternantia, et cum iis hypogyna, carnosula, cuneatim subdeltoidea, summo sub-bilabiata, labiis emarginatis, erecto-patentia, glaberrima. *Ovarium* rudimentarium, discum parvum depressum subplanum mentiens, *stylo* obsoleto mammæformi notatum, dense lepidotum.—*Fœm. Bracteola, sepala*, et *petala* maris. *Stamina* 5, sterilia, hypogyna, ovario adpressa, persistentia; *filamenta* linearia, compressa, erecta, imo paulo curvata, apice obtusatim emarginata, intus glandulis 2 polline destitutis apiculata. *Staminodia* 5, cum staminibus alternatim hypogyna, iis dimidio breviora, et duplo latiora, erecta, compressa, extus sulco notata, apice emarginata, persistentia. *Ovarium* ovatum, subgibbum, petalis paulo brevius, crebriter lepidotum, 1-loculare; *ovula* 2, collateralia, summo lineæ parietalis prominentis suspensa. *Stylus* subtenuis, teres, glaber, ovarii tertia parte longitudinis, valde deflexus. *Stigma* breviter 2-furcatum, furcis acutis. *Drupa* exsucca, inversim obovata, sublepidota, stylo marcido apiculata: *putamen* coriaceo-chartaceum, 1-loculare, 2-spermum. *Semina* plano-convexa, ex apice pendula; *integumenta* membranacea, imo *chalaza* parva signata. *Embryo* in summo *albuminis* carnosi et ejus dimidio longitudine immersus; *cotyledonibus* foliaceis, subdeltoideo-cordatis; *radicula* tereti, subulata, subæquilonga, summo spectante.

Arbor *Chilensis:* folia *alterna aut subopposita, oblonga, supra glabra, subtus lepidota, breviter petiolata, exstipulata;* racemi *axillares, folio breviores, leproso-lepidoti:* flores *parvi.*

1. *Ӕxtoxicum punctatum,* R. & P. Syst. Veg. Per. p. 260; Prodr. Flor. Per. et Chil. p. 131, tab. 21; Hook. Icon. i. tab. 12; Gay, Chile, v. 348;—ramulis teretibus, griseo-opacis, nigro-punctulatis, junioribus rufescentibus; foliis subalternis vel oppositis, oblongis, utrinque subacutis, aut obtusis, subcoriaceis, supra in junioribus sparsim lepidotis, in adultis glabris, subtus e squamulis peltatis, radiatim nervosis, margine ciliatis dense griseo-furfuraceis et ferrugineo-lepidotis; petiolo brevi; racemis simplicibus, axillaribus, folio paulo brevioribus, floribus parvis.—Chile, *v. s. in herb. meo et aliorum* e Quillota (Bridges, 505); Cauquenes; Concepcion (Macrae et Harvey); Valdivia (Bridges, 558): Chile (Cuming) ♂; Maule (Germain) ♀.

A tree of moderate size, growing sometimes to the height of 40 feet, found in most of the central and southern provinces of Chile, where it is known by the several names of *Aceytunillo, Palo muerto,* and *Téque* or *Téke.* Its leaves are 3 inches long, $\frac{3}{4}$–$1\frac{1}{4}$ inch broad, on a petiole of 3 lines; the axillary racemes are 1 inch long; the pedicels $1\frac{1}{2}$ line, the flower in bud $1\frac{1}{4}$ line, the flower expanded $3\frac{1}{2}$ lines diameter; the sepals $\frac{1}{2}$ line diam.; the petals 2 lines long: the female raceme is shorter (3–6 lines long), with flowers similar in size to those of the ♂; the drupe is 4 lines long, 3 lines diameter*.

Bursinopetalum.

More than ten years ago, in alluding to the structure of this genus†, I suggested that its characters were more in accordance with the *Aquifoliaceæ* than with *Olacaceæ,* to which family it had been referred. Since then (in 1855) Mr. Thwaites published an interesting note‡, in which he stated that he had examined living specimens, which led him to the conclusion that its real affinity was with *Araliaceæ,* pointing out the resemblance of its flowers to those of *Hedera.* I have recently repeated carefully my former investigation, and am again struck with the many points of resemblance it offers to the structure of *Villaresia.* One of these characters—the imbricate æstivation of the corolla

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* This plant, with full analytical details, is figured in Plate 72.

† Contributions to Botany, i. 29; Ann. Nat. Hist. 2 ser. viii. 169.

‡ Hook. Kew Journ. Bot. vii. 242.

—has been denied by Mr. Thwaites, who states that, after examining the flowers of *Bursinopetalum* in the living state, he is convinced that it is valvate. It appears to me, however, that he has drawn this conclusion too hastily. I have observed, in the flowers of *B. arboreum,* which are 5-merous, that the margins of the petals distinctly overlap each other quincuncially, not to any very great extent, it is true, but sufficiently so to render the fact incontestable; besides which, the apices of the petals are at the same time deeply inflected (as in *Stemonurus*); but, owing to the manner in which these inflected portions are held together by their imbricated plicature, I have found, in attempting to unravel the bud, that the petals do not open, because the whole corolla falls off in a cupular form with a slight touch. If the petals in this state be spread out radially when held together (as just stated) by their apical plicature in the centre, the quincuncial character of its æstivation then becomes palpably evident. I have seen the flower of *Bursinopetalum tetrandrum* only in bud, where I found the apices of the four petals overlapping each other in the apex, the more interior petal being opposite to the more exterior: this I could not unravel, as the petals adhered together so forcibly as to resist the attempt to separate them; but on making a cross-section, I observed that, at the junction of the petals, the margins were not square and valvate, but were all considerably inclined, their chamfered edges overlapping each other in a direction corresponding to the indications seen at the apex. The extent of this overfolding in the latter species (which is the one mentioned by Mr. Thwaites) is small, so that under a hasty examination it might be mistaken for a valvate junction of the margins; in the former species, the imbricate overlapping of the edges is so considerable as to admit of no doubt.

In the general habit of *Bursinopetalum,* in the form of its simple leaves and simple joints, there is nothing to show any approach to the *Araliaceæ*: its inflorescence is always in a trichotomous panicle, not umbellate as in that family; the ovary is only half inferior, and always unilocular, with a single suspended ovule: in these respects, as well as in the æstivation of the corolla, *Bursinopetalum* is irreconcilable with *Araliaceæ*. On the other hand, the form of its calyx, its five petals imbricated in æstivation, deeply inflexed at the apex, and with an internal carinated nervure—its five alternate stamens rising from the margin of the ovary, with subulate filaments spreading towards the base—a one-celled ovary, with an ovule suspended from a longitudinal parietal expansion of the placenta—a simple style —a dry 1-locular drupe, with a coriaceous indehiscent putamen, enclosing a single seed that fills its cavity and is moulded in a horse-shoe form round the longitudinal parietal expansion, which extends nearly to the centre of the cell—a fleshy albumen, enclosing in its summit an embryo with a superior terete radicle —are all characters surprisingly in accordance with *Villaresia*, the principal point of its disagreement being its inferior fruit. With this single exception, *Bursinopetalum* is quite conformable with the *Aquifoliaceæ*; and even this exception, making due allowance for its aberrance, in great measure may be reconciled. The ovary, with its fleshy summit assuming the appearance of an epigynous disk, as in *Styraceæ*, is half superior, that is to say, its cell rises above the level of the insertion of the stamens; and we find a parallel of this instance in *Halesia*. I have shown how it happens in that genus*, contrary to what occurs in *Styrax* and its congeners, that the superior moiety of the ovary remains almost unchanged, while the principal growth takes place in the lower moiety, from which it results that a half-superior ovary becomes converted into an inferior fruit. Now, precisely the same occurrence takes place in *Bursinopetalum*; and if on this account we were to deny its right to rank in *Aquifoliaceæ*, then, for the same reason, we ought to exclude *Halesia* from the *Styraceæ*, which few would venture to propose. For the same reason that the *Halesieæ* have been made a tribe of the *Styraceæ*, *Bursinopetaleæ* may be considered a second tribe of the *Aquifoliaceæ*, the *Ilicineæ* being the first.

I will add, in justice to Mr. Thwaites, that three years subsequently to his note before mentioned, in his 'Enumeration of Ceylon Plants' (1858), he abandoned his former conclusion; for he there classes *Bursinopetalum* among the *Olacaceæ*, meaning, I presume, Mr. Bentham's tribe *Icacineæ*. Mr. Thwaites has thus ignored the unquestionable grounds upon which the *Icacineæ* must remain separated from *Olacaceæ*. The *Icacinaceæ*, I have shown, must be a distinct order, contiguous to the *Aquifoliaceæ*, the one only differing from the other in the æstivation of the corolla. This last arrangement of Mr. Thwaites brings *Bursinopetalum* close to the place I have assigned it; and if the æstivation of its corolla had been truly valvate, his determination would have been perfectly correct, according to the Candollean arrangement; but as the case is otherwise, the genus falls into *Aquifoliaceæ*, under the condition above proposed.

Mr. Thwaites is perfectly correct in his statement that the raphe is on the face of the seed opposite to the projection in the cell round which the seed is folded, but is wrong in his inference that, because it is so, such a projection can have nothing to do with the placenta: the fact is that not only in this instance, but in others of this family, as also in different orders of the

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* Contributions to Botany, i. 168; Ann. Nat. Hist. 3 ser. iii. 137.

Celastral alliance, and particularly, as I have demonstrated, in the *Icacinaceæ*, the raphe is frequently dorsal; and I have ventured to explain the cause of this occurrence in my memoir on the development of the anatropal ovule*. Mr. Thwaites has been unable to discover any incomplete dissepiment in the fruit of this genus, but only an inflexion of the putamen: this is simply a difference in terms; for it is undeniable that such a thick semiseptum exists, and is well figured by Dr. Wight (Icon. 956. f. 8). In the ovary, the rudiment of this projection is seen in the parietal nervure which extends from the apex to the base, and from the summit of which the ovule is suspended, as in *Villaresia*; this nervure, in both instances, is the displaced axis of the abortive cells, and contains the nourishing-vessels of the placenta.

The incrassation of the summit of the ovary in this genus assuming the appearance of an epigynous disk is not an uncommon feature even in the superior ovary, as I have long ago indicated in *Hyoscyamus*, in most of the *Olacaceæ*†, *Santalaceæ*, *Icacinaceæ*, and *Styraceæ*.

BURSINOPETALUM, Wight. — *Flores* polygami. *Calyx* semiadnatus, apice liber et in dentes 5 acutos divisus. *Petala* 5, dentibus calycinis alterna, oblonga, apicibus 2–3-dentatis introflexis, intus nervo carinæformi instructa, in æstivatione quincuncialiter imbricata, valde decidua. *Stamina* 5, petalis alterna; *filamenta* subulata, subcomplanata, imo dilatata; *antheræ* 2-lobæ, lobis segregatis, ad connectivum carnosum cordiformem filamento apicifixum dorso collateraliter adnatis, singulis 2-locellatis, et rima longitudinali introrsum dehiscentibus. *Ovarium* semisuperum, in ♂ depressum, et radiato-sulcatum, in ♀ conicum, glandula disciformi apiculatum, 1-loculare, 1-ovulatum: *ovulum* e summo placentæ longitudinalis parietalis carinæformis suspensum. *Stylus* brevis, crassus, apice truncatus et cavus. *Stigma* obsoletum, in cavitate styli sistens. *Drupa* sicca, ovalis, dentibus calycinis emarcidis coronata; *putamen* coriaceum, crassissimum, indehiscens, revero 1-loculare, sed ob incrementum placentæ, nunc in laminam crassam longitudinalem fere ad axin loculi prolatæ, semibiloculare, monospermum. *Semen* suspensum, loculum implens, et hinc circa semiseptum longitudinale plicatum; *testa* e laminis 2 farctura cellulosa repletis crassiuscula, laxa, ad endocarpium semiadhærens, *raphe* dorsali chordiformi ea immersa; *integumentum internum* tenuissimum, testa multo minus, albumen

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* Contributions to Botany, i. 209; Ann. Nat. Hist. 3 ser. iv. 24.

† Contributions to Botany, i. 37; Ann. Nat. Hist. 2 ser. viii. 177.

arcte vestiens; *albumen* parciusculum, scaphiforme, utrinque acutum, testa æquilongum; *embryo* (sec. cl. Wight) parvus, in apice albuminis sepultus, *cotyledonibus* parvis acutis *radicula* tereti imo spectante tertia parte brevioribus.

Arbores *Indiæ Orientalis et Zeylaniæ, frondosæ;* folia *alterna, elliptica, integra, subcoriacea, petiolata;* paniculæ *corymbosæ, terminales;* flores *subparvi.*

1. *Bursinopetalum arboreum,* Wight, Spicil. Nielg. i. 22, tab. 24; Icon. iii. tab. 956; Walp. Ann. i. 124; Thw. Enum. Pl. Zeyl. 42;—ramulis rugosis, subflexuosis; foliis ellipticis, imo acutis et in petiolum subdecurrentibus, apice reflexis et repente angustato-attenuatis, acumine obtusiusculo, margine subrevoluto, superne paulo infuscatis, in nervis immersis sulcatis, subtus pallidis, nervis utrinque 3 venisque transversim reticulatis prominulis; petiolo longiusculo, angusto, canaliculato; panicula terminali, corymbosa, trichotome divisa, brachiis ultimis 3-floris, bracteolatis; floribus breviter pedicellatis. —India Orientalis, *v. s.* (*in flore*) *in herb. Hook.*; *in fructu in herb. meo*; Nielgherry (Wight et Gardner).

In my authenticated specimen, the leaves are 2½–2¾ inches long, 1¼–1⅝ inch broad, on a petiole 9 lines in length; the corymb is 2 inches broad and long, its primary branchlets are alternate, the secondary are trichotomous, each forklet bearing three pedicellated flowers at its apex; the pedicles are 1 line long, and the flower expanded 3–4 lines diameter. The drupe is 1¼ inch long, 9 lines diameter; the putamen is ligneous, its sides being 2 lines thick, its cell 5 lines in diameter, with the false septum, 1 line in thickness, reaching to the axis of the cell; the testa measures 5 lines across, and the tegmen 3 lines, both plicated in a horse-shoe form round the false septum. In the fruit I examined, the embryo was not perfected*.

2. *Bursinopetalum macrophyllum,* Thw. in Hook. Kew Journ. Bot. vii. 242; Enum. Pl. Zeyl. 43;—ramulis strictis, subangulatis, opacis, fuscis; foliis ovato-oblongis, imo subacutis, et in petiolum subdecurrentibus, apice rotundato-obtusis, marginibus valde revolutis, subcoriaceis, supra fuscis, convexis, nervis invicem 7–8 venisque reticulatis utrinque prominulis, subtus subpallidis; petiolo costaque latiusculis, superne planis; corymbo terminali.—Ceylon, *v. s. in herb. meo*; Ramboddi, 5000 ped. altit. (Gardner, 100).

This† appears, by comparison with the foregoing, to be a

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* Structural details of this species are shown in Pl. 73.

† A figure of this plant and section of its fruit are given in the same Plate.

very distinct species, as their characters respectively show. The leaves are $3\frac{1}{2}$–4 inches long, 2–$2\frac{1}{4}$ inches broad, on a petiole of 9 lines long and 2 lines broad. The fruit is of the same form, size, and structure as in the preceding species.

3. *Bursinopetalum tetrandrum,* Thwaites, Enum. Pl. Zeyl. i. 42.—Ceylon.

I saw long since, in Sir Wm. Hooker's herbarium, a plant collected in Malacca by Griffith, which in its habit and floral structure agrees with *Bursinopetalum.* Although its flowers are tetrandrous, I hardly think it will be found identical with the Ceylon plant.

ON GOUPIA.

THE place which this little-known genus should occupy in the system has not yet been satisfactorily established, although its typical species was described and figured by Aublet (Pl. Guy. i. 296, tab. 116) more than eighty years ago. Willdenow considered it to belong to the *Araliaceæ.* Jussieu placed it in *Rhamnaceæ*—a view that was afterwards adopted by most botanists. Endlicher, however, classed it among the dubious genera of *Celastraceæ,* which opinion was followed by Dr. Lindley in his 'Vegetable Kingdom' (p. 588). All these conclusions were founded on the drawing and description of Aublet, as no other botanist up to that time appears to have examined the genus. Mr. Bentham, however (in 1852), gave more ample details of its floral structure (Kew Journ. Bot. iv. 11), on which he founded an emended generic character. Notwithstanding the many interesting facts there communicated, he regarded its position in the system as still uncertain: he remarked that the alternation of the stamens with the petals favoured the opinion of its affinity with the *Celastraceæ;* but he considered that the structure of the ovary brought it nearer to the *Büttneriaceæ,* because it is crowned by five divaricated styles and its ovules are affixed to the axis of a 5-celled ovary. Recently (in 1861) Dr. Reisseck (in Mart. Flor. Bras. xxviii. p. 34) gives his opinion positively that *Goupia* differs in no respect from the *Büttneriaceæ,* except in its baccate fruit, and that its immediate affinity is with the *Büttneriæ* and *Theobromeæ*: though speaking so decidedly, he cannot have examined the structure of the genus, as otherwise, I am convinced, he could not have come to this conclusion.

With all the respect due to so distinguished an authority as Mr. Bentham, I beg to suggest that *Goupia* offers very slender claims of affinity towards the *Büttneriaceæ.* My reasons are founded on the alternate (not opposite) position of the stamens with regard to the petals; that they are all free and isomerous, without any tendency to become monadelphous or to be double the number of the petals; its anthers are introrse (not extrorse), and the æstivation of the petals is strictly valvate (not convolutely imbricate); to which may be added, the umbellated disposition of its axillary flowers. This eminent botanist considered that the anthers are sessile upon the margin of a monadelphous staminal tube, whereas I have noticed that they are perfectly free, being furnished with distinct filaments, in no way connected together, and seated round the ovary within a cupular disk, as in *Calypso campestris*, Camb.*, and in *Hippocratacecæ.*

Before I proceed to indicate what I conceive to be the real position of *Goupia*, it will be necessary to detail minutely all that I have observed during a very careful examination of its floral and seminal structure. It has a small cup-shaped calyx covered with a dense short pile, and is deeply divided into five acute erect teeth, which have an imbricated æstivation. The corolla consists of five linearly oblong, glabrous, fleshy petals, more than six times the length of the calyx, their straight margins being deeply introflexed and valvate in æstivation; and their appendiciform apices, measuring half their length, are suddenly inflected and united together in the axis of the flower by their valvate margins; they originate in the bottom of the calyx outside and around the disk, being alternate with the calycine teeth; when the flower opens, they become horizontally expanded, with the inflected apices standing erect at right angles with them. The disk forms a notable feature in this structure, being nearly the size of the calyx, quite cup-shaped, with five very short teeth, which alternate with the stamens. The five stamens are erect, and stand *within* the disk, free from it as well as from the ovary; the filaments are short, subulate, and glabrous, supporting a much broader and thicker linear connective, which, extending beyond the anthers, is truncated at its summit, where it is furnished in front with a horizontal tuft of long hairs, its margins, behind the anthers, being ciliated with similar hairs: the anthers are bilobed, cordate at base, double the breadth of the connective, to which they are attached by their whole length; they are introrse, each lobe opening by a longitudinal and somewhat oblique fissure; one-half of each anther rises above the margin of the disk, and their long apical horizontal tufts of hair meet in the middle of the ovary, passing between the styles, thus serving as collectors to convey their pollen to them. The ovary is spherical, five-grooved, and somewhat depressed in the centre, where a small umbonate point is seen; and at some distance from this centre five distinct styles originate, which are rather short, very distant from each other, somewhat erect and divergent, there being no distinguishable stigmata, except their merely glandular points; the ovary has five equal complete cells ranged round a central axis, the dissepiments corresponding with the external grooves and alternating with the styles; there are several ovules in each cell, all standing erect and crowded together at the base of the inner angles of the cells. The fruit is spherical, and 2 lines in diameter; it has been incorrectly described as a berry, but its fleshy sarcocarp encloses an indehiscent 3–5-grooved, 3–5-celled nut, the walls and dissepiments of which, though very thin, are crustaceous; each cell contains one, more generally two or three, erect black seeds. The seed is oval when it is solitary, planoconvex when there are two, or angular when there are three seeds in each cell: it is covered by a smooth and very fleshy tunic, marked on its ventral face by a prominent line; this cannot be an arillus, because it contains the simple chord of the raphe, which extends from a somewhat lateral and basal hilum to a small hollow in its summit, which it penetrates to reach the second tunic; it is analogous to the same kind of covering as that I have described in *Magnolia* and *Clusia*, and designated as an *arilline**, being a fleshy development of the primine of the ovule: the next is a hard testaceous shell, regularly oval, densely pitted by minute hollows arranged longitudinally in parallel lines; it cannot be the testa, because it has no raphe, being a growth of the secundine of the ovule; in its summit there is a hollow, with a small diapylar hole, through which the chord of the raphe passes to reach the chalaza of the inner membranaceous integument or *tegmen*, which closely invests the fleshy albumen. The embryo is somewhat shorter than the albumen, in which it is imbedded, but is much narrower; the cotyledons are oblong-ovate and foliaceous, equal in length to the terete radicle, the extremity of which reaches the base, and is therefore close to the hilum of the seed.

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* St.-Hil. Flor. Bras. ii. 3, tab. 104.

We have here a structure which does not correspond in all its characters with any particular family, but which evidently belongs to the *Celastral* alliance. It agrees with the *Hippocrataceæ* in the position of its stamens within a cupular disk, but differs in the imbricate æstivation of its petals and in the position of its ovules. It accords with the *Celastraceæ* in its erect ovules originating in the base of the cells of the ovary, the external tunic of its seeds being an arilline, that is to say, a fleshy coating containing the vessels of the raphe, and covering an internal testaceous integument; but it differs in the position of its stamens in regard to the disk, and in the æstivation of its petals. It agrees with the *Icacinaceæ* in the æstivation of its sepals and petals, in the long apical inflection of the petals (as in *Mappia*, *Stemonurus*, &c.), in the hairy appendages of its stamens (as in *Stemonurus*), and in the number of cells in its ovary (as in *Emmotum*); but it differs in the position of its stamens with respect to the disk, and in its erect ovules and seeds.

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* Linn. Trans. xxii. 80; Contributions to Botany, i. 211; Ann. Nat. Hist. 3 ser. iv. 26.

If we maintain any consistency in our demarcations of the limits of these several families, *Goupia* cannot be admitted into any of them, and it must stand as the type of a distinct group, which I propose to call *Goupiaceæ*, distinguished by the following characters:—

GOUPIACEÆ.—*Flores* hermaphroditi vel subpolygami. *Calyx* parvus, 5-dentatus, dentibus æstivatione imbricatis. *Petala* 5, linearia, æstivatione introflexo-valvata, apicibus longe propendentibus introflexis. *Stamina* 5, libera, introrsa, brevia, cum petalis alterna, intra *discum* cupuliformem hypogyna. *Ovarium* globosum, 5-loculare; *ovula* plurima in quoque loculo, erecta, et anatropa. *Styli* 5, subulati, breves, late segregati, subdivaricati, cum dissepimentis alterni. *Stigmata* subnulla. *Drupa* globosa, carnosula; nux tenuissimus, 3–4–5-locularis, loculis 1–2–3-spermis. *Semina* erecta; *integumentum externum* (arillina) carnosulum, raphigerum, *raphe* simplici, dorsali; *integumentum secundum* testaceum, evasculosum. *Albumen* carnosum. *Embryo* orthotropus. *Cotyledones* foliaceæ; *radicula* teres, ad hilum spectans.

Arbores *frondosæ Guianenses*; folia *petiolata, paucinervia, venis crebris, parallelis, transversis*; stipulæ *subulato-lineares*; flores *axillares, parvi, umbellati.*

On a former occasion, when discussing the question of the relative affinities of the *Icacinaceæ* with the *Celastraceæ*, *Hippocrataceæ*, *Aquifoliaceæ*, &c.[*], and determining the position of the former in the system[†], I exhibited in a tabular form the leading differential features of the several families that enter into the Celastral alliance. I now repeat the same under a more synoptical form, including the *Goupiaceæ*.

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[*] Contrib. to Bot. i. 27–29, 50; Ann. Nat. Hist. 2 ser. viii. 167–169, ix. 220.

[†] Contrib. to Bot. i. 51; Ann. Nat. Hist. 2 ser. ix. 221.

- 1. Æstivation of petals imbricate.
  - A. Stamens outside disk.
    - α. Ovules erect, with a ventral raphe, or suspended, with a dorsal raphe; seed albuminous .... *Celastraceæ.*
    - β. Ovules suspended*; seed exalbuminous.... *Chailletiaceæ.*
  - B. Stamens inserted inside or upon disk .... *Hippocrataceæ.*
  - C. Stamens hypogynous; disk almost obsolete.
    - α. Ovules suspended, with a dorsal raphe; cotyledons large in regard to radicle .... *Aquifoliaceæ.*
    - β. Ovules suspended, with a ventral(?) raphe; cotyledons small .... *Cyrillaceæ.*
- 2. Æstivation of petals valvate
  - A. Stamens inserted inside disk; ovules erect....... *Goupiaceæ.*
  - B. Stamens inserted outside disk; ovules suspended *Icacinaceæ.*

I may here observe that an essential point in the development of the ovules and seeds in the several groups above enumerated is the relative position of the raphe. It has been shown that an erect ovule with a dorsal raphe is a mere resupination of a suspended ovule with a ventral raphe, and that a suspended ovule with a dorsal raphe is equivalent to an erect ovule with a ventral raphe, the former being a reversion of the ovule upon its funicle by the mere effect of pressure. These are distinctions of some value, which are generally neglected, but which ought always to be recorded. It will hence be seen that, although in one case the ovules are suspended and in the other erect, there is a nearer approximation in their development in the *Icacinaceæ* and *Goupiaceæ* than the position of the raphe at first sight indicates. This circumstance and the valvate æstivation of the corolla bring them into close proximity; but the insertion of the stamens in regard to the disk, the distantly separated styles, more numerous ovules and seeds, the nature of the seminal integuments, and other characters claim for the *Goupiaceæ* a very distinct position.

I offer here a more ample diagnosis of the genus under consideration founded on my own observations:—

Goupia, Aubl.; — Gupia, *Jaume St.-Hil.*; — Glossopetalum, *Schreb.*;—*Calyx* parvus, cupuliformis, 5-dentatus, dentibus acutis, æstivatione imbricatis. *Petala* 5, inter discum et calycem inserta, cum dentibus calycinis alterna, oblongo-linearia, apicibus longe attenuatis et inflexis, æstivatione e marginibus profunde introflexis valvata. *Discus* cupuliformis, calyce vix minor, inter petala et stamina enatus, omnino liber, glaber, dentibus 5 minimis remotis cum staminibus alternis margine instructus. *Stamina* 5, inter discum et ovarium inserta, cum petalis alterna, e basi erecta, omnino libera, discum paulo exce-

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* With a dorsal raphe, according to Agardh, Syst. 294.

dentia; *filamenta* brevia, subulata, compressa, in *connectivum* latum apice truncatum ultra antheras extensum et hinc pilis longissimis patentibus intus instructum marginibusque pone antheras longe ciliatum summo expansa. *Antheræ* bilobæ, imo cordatæ, ad connectivum dimidio angustius dorso adnatæ, lobis ovatis, obliquis, utrinque rima longitudinali subintrorsum dehiscentibus. *Pollen* globosum, 3-sulcatum. *Ovarium* depresso-globosum, disco fere omnino occultum, liberum, glabrum, 5-sulcatum, apice umbone punctiformi signatum, 5-loculare; *ovula* in quoque loculo plurima, fasciculata, e basi ex angulo versus axin adscendentia, cum *raphe* ventrali. *Styli* 5, remotiusculi, subulati, breviusculi, subradiatim divaricati, cum sulcis et staminibus alterni; *stigmata* inconspicua, glandulosa. *Fructus* drupaceus, globosus, calyce immutato suffultus; *pericarpium* pergamineo-coriaceum, sulcatum, indehiscens, 3–4–5-loculare, dissepimentis sulcis oppositis, loculis 1-2–3-spermis. *Semina* e basi erecta, oblongo-ovata; *integumentum externum* (*arillina*) carnosulum, læve, *raphe* ventrali lineari immerso prominente, *hilo*que fere basali parvo cavo notatum: *integumentum secundum* testaceum, durum, lineis creberrimis longitudinalibus rugulosis signatum, apice *chalaza* circulari parvula centro (pro raphes vasorum introitu) perforata instructum; *integumentum internum* tenuissime membranaceum, pellucidum; *albumen* solidum, carnosum. *Embryo* orthotropus, albumini paululo longiori immersus; *cotyledones* ovali-oblongæ, foliaceæ, compressæ, *radicula* tereti ad basin attingenti subæquilongæ.

Arbores *Guianenses et Brasilienses*; folia *alterna, ovato-lanceolata, integra, acuta, speciosim venosa, petiolata*; stipulæ *utrinque lineares, acutæ, deciduæ*; pedunculi *solitarii, axillares*, pedicellos *plurimos umbellatos* 1-*floros apice gerentes*; flores *minimi.*

1. *Goupia glabra*, Aubl. Pl. Guian. i. 296, tab. 116; Lam. Dict. iii. 15, tab. 217; DC. Prodr. ii. 29; Benth. in Hook. Kew Journ. iv. 12; Reisseck in Mart. Flor. Bras. fasc. 28. p. 34;—Glossopetalum glabrum, *Schreb. Gen. Pl.* No. 526; *Willd. Sp. Pl.* No. 588;—arbor excelsa, ramosa; ramulis angulato-striatis subflexuosis; foliis ovato-lanceolatis, acuminatis, integris, basi inæqualibus, utrinque glabris, nitidis, nervis utrinque 3–4 remotis obliquis, 2 inferioribus suboppositis, venis creberrime parallelis et transversis reticulatis speciosim signatis, subtus minutissime albo punctulatis; petiolo tereti; stipulis linearibus, caducissimis; pedunculis axillaribus, solitariis, petiolo sub-brevioribus, pedicellis illis longioribus gracillimis 20–24 umbellatis, unifloris, imo bracteolatis; fructu

globoso, carnoso, piperis magnitudine.—Cayenne et Brasilia Septentrionalis, *v. s.*; prope Panuré, Rio Uaupes (Spruce, No. 2624).

One of the most conspicuous features in this plant is the elegant disposition of the veins in its leaves, greatly resembling in this respect the leaves of *Poraqueiba Surinamensis**, belonging to the *Icacinaceæ*. The internodes are about $\frac{3}{4}$ inch apart; the leaves are 4–5 inches long, 1–2 inches broad, on a petiole 4 lines in length; the stipules are 4 lines long, $\frac{1}{2}$ line wide; the peduncle is 3–4 lines, the pedicels 6 lines long; the calyx is $\frac{1}{2}$ line long; the petals are 4 lines long (including the inflected apex of 1 line); the drupe is 2 lines in diameter †.

2. *Goupia tomentosa*, Aubl. *loc.cit.*;—Arbuscula, precedenti subsimilis, cortice foliisque valde amaris; foliis utrinque hirsutis. —Guiana et Ins. Cayenne.

ON EPHEDRA.

BEFORE I publish my observations on the *Anacardiaceæ*, I wish to offer some remarks on *Ephedra*, for this reason, that the mode in which the ovule is fecundated in the *Gnetaceæ* affords a probable clue to the solution of an enigma in the former family which is otherwise difficult of explanation. My memoranda and drawings from living plants of *Ephedra* were made more than thirty-five years ago, at which period I found several species growing in Chile, in the Cordillera of the Andes and in the neighbourhood of Mendoza, the structure of which excited my particular attention; but, being then a mere tyro in botanical investigations, it never occurred to me to notice the development and growth of its ovary. I have lately repeated my analyses of these plants (now in a dried state), guided by a better knowledge of their organization; but, before I detail the results obtained, I will first quote the opinions of botanists in regard to the structure and affinities of the family, and will then give the reasons upon which my own views are founded.

The family of the *Gnetaceæ*, first established by Blume in 1834, until very recently consisted only of the genera *Gnetum* and *Ephedra*, which are so extremely different in habit that previous botanists had no idea of their close proximity.

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* 'Contributions,' vol. i. pl. 10.

† This species, with full analytical details, is represented in Plate 74.

Jussieu (in 1789)* arranged *Ephedra* in *Coniferæ*, where, together with *Casuarina* and *Taxus*, it entered into his first section of that family, while *Gnetum* was considered to be more allied to *Urticaceæ*, near *Misodendron*, *Piper*, and some others.

Poiret (in 1808)† looked upon *Ephedra* as allied to *Casuarina* and *Taxus*, but seemed to have had no idea of its relation to *Gnetum*, in regard to the affinity of which genus he offered no opinion.

Richard (in 1810) ‡ placed *Ephedra* in *Coniferæ*, following *Salisburia* in his tribe *Taxineæ*; but he made no mention of *Gnetum*.

Mirbel (in the same year) § gave *Ephedra* a similar position: he, too, seemed to ignore the relationship of *Gnetum*.

Robert Brown (in 1814)‖, speaking of *Coniferæ*, and referring to the view of Mirbel that the female fructification is a pistillum with a perforated style, observed that this argument "is derived from the genus *Ephedra*, in which both the stigma and a considerable part of the style project beyond this cupula (pericarpium), without cohering with its aperture; and in confirmation of this opinion it may be observed that I have found a projection of the stigma, though certainly in a much less obvious degree, both in *Agathis* and *Podocarpus*." It is evident that this great botanist at that time had a very imperfect knowledge of the real structure of *Ephedra*; for he then considered the pericarp to be a modified disk, and the integuments of the seed to be the pistillum. At a later period, however (in 1825)¶, in his celebrated memoir on *Kingia*, remarking upon *Cycadaceæ* and *Coniferæ*, he corrected his former opinion, having noticed that its supposed style is in reality the elongated tubular apex of the seminal integument.

Blume (in 1834)**, in establishing the family of the *Gnetaceæ*, where he first associated *Gnetum* with *Ephedra*, gave a novel and, to my mind, the truest interpretation of the ordinal structure and affinities of this small group: to his opinions I will presently refer. It is to be regretted that his views in regard to the nature of its several structural parts have not been adopted by subsequent botanists, who have greatly mystified the subject by employing different sorts of nomenclature for the several floral and seminal parts, in order to accommodate these expressions to their notion of the close affinity of the *Gnetaceæ* with *Coniferæ* and *Cycadaceæ*, and to the doctrine of naked seeds, as applied to those families.

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* Genera Plantarum, pp. 411 and 406.

† Dict. vii. p. 276.

‡ Ann. Mus. xvi. p. 297.

§ *Ib.* p. 458.

‖ Gen. Rem. p. 572.

¶ Append. King's Voy. p. 64.

** Ann. Sc. Nat. 2 sér. ii. p. 101.

Dr. Lindley (in 1836) * placed the *Gnetaceæ* among Gymnosperms, next to *Cycadaceæ* and *Coniferæ*, but at the same time confessed that, having examined dried seeds of *Gnetum*, he felt inclined to favour the view of Blume, whose opinion he quoted at length, showing that the *Gnetaceæ* possess a far higher degree of organization, tending to a much nearer approach to *Casuarina* than to either *Coniferæ* or *Cycadaceæ*.

Endlicher (in 1837) † arranged the *Gnetaceæ* in his class *Coniferæ*, after *Taxineæ*, and, although preferring this position, he admitted their approach to *Casuarina* through *Ephedra*, on the one hand, on account of its aphyllous habit and the structure of its female flowers, and to *Chloranthaceæ*, on the other, through *Gnetum*, because of its fully-developed leaves.

Meyer (in 1846) ‡ published a monograph of *Ephedra*, which he prefaced by an inquiry into the nature of the flowering parts and seminal integuments in *Gnetaceæ*: he there confirmed Brown's later view of the origin of the tubillus, which he showed to be a mere elongation of the micropyle of the inner integument; but he adopted the view of Richard in calling the pericarpial covering of the fruit an "involucellum," although he considered it rather in the nature of a perigonium: he there called the entire fruit a "pseudo-nucula."

Dr. Lindley (in 1846) § followed his previous view of the position of the *Gnetaceæ* among Gymnosperms; but he adopted the notion of Griffiths in respect to the pericarpial covering of the seed, which he regarded as one of its proper seminal integuments, adding, "there can be no doubt that in reality *Gnetum* is as truly naked-seeded as conifers themselves."

A very interesting posthumous memoir of the late Mr. Griffiths on the structure and development of the ovule of *Gnetum* was read before the Linnean Society in 1859 ‖, although a portion of the same appeared (in 1846) in the first edition of Lindley's 'Vegetable Kingdom' (the original memoir bearing the date of August 1835) ¶. This memoir endeavoured to prove that the ovule of *Gnetum* is naked, that is to say, not contained in a carpel, but enveloped in three or four distinct proper integuments, which, being open at the summit, allow the direct action of the pollen upon the nucleus. That ingenious botanist concluded, from the facts he adduced, that the *Gnetaceæ* are truly gymnospermous, and more nearly allied to *Cycadaceæ* than to *Coniferæ*.

Lastly, Agardh (in 1858), ** following the opinion of Richard, that the ovule is quite naked, that the inner integument with its tubillus is the true pistillum with its exserted style, and that the outer seminal integument and the pericarp are its persistent floral envelopes, inferred that its naked ovule is a mere embryo-sac, analogous to that of the *Santalaceæ,* and that the *Gnetaceæ* are closely allied to the *Viscaceæ* and the *Loranthaceæ,* although analogous to the *Coniferæ,* to which *Ephedra* more especially osculates.

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* Introd. Bot. p. 311.

† Gen. Plant. p. 262.

‡ Mem. Acad. St. Petersb. v. pp. 35–108. 8 tab.

§ Veg. Kingdom, p. 232.

‖ Linn. Trans. xxii. p. 299.

¶ Veg. Kingd. p. 233.

** Theor. Syst. p. 113.

We may perceive, from this history, how confused are the opinions of botanists in regard to the structure and to the position and affinities of this small order. This confusion has arisen from the assumption that the ovule in the *Gnetaceæ* is naked; but I can perceive nothing in the structure of *Ephedra* to support this assumption, as the organization of its carpel seems to me quite in accordance with the usual structure of perfect dicotyledonous plants, under some peculiar modifications which are likewise found in families of a very high degree of development. Blume correctly considered the pistillum as an "ovarium," containing a nucleus surrounded by the two usual integuments ("spermoderms"), and the fruit as a "baccate drupe," consisting of a coriaceous "pericarp," containing an albuminous seed invested by two regular integuments. This same female organ was, however, regarded by Richard as an entire flower, the ovarium and pericarp of Blume being, in his estimation, an "involucellum," the outer integument its "calyx," and the inner integument its "pistil" with an "exserted style," the enclosed nucleus and subsequent albuminous mass being considered to be naked, and deficient of any proper integument. Meyer likewise denominated the ovary and pericarp an "involucellum," forgetting that this supposed involucel is at first contained within a petaloid perigonium in *Gnetum* as well as in *Ephedra*; and though he admitted the existence of the two integuments within his "involucellum," he still considered the nucleus and its subsequent albuminous mass as being "naked." Griffiths, on the other hand, regarded the pistillum as a naked ovule, covered by three integuments, thus considering the real carpel as the primine and testa, the outer proper integument of the seed as the secundine, and the inner coating with its tubillus as an accessory integument of adventitious growth. Such are the various self-evident contradictions to which botanists have been obliged to have recourse in order to support their favourite doctrine of the existence of a naked ovule in *Gnetaceæ.*

Ephedra is distinguished from *Gnetum* by the absence of properly developed leaves and by a different form of inflorescence. They are both sparsely spread over both hemispheres, the former generally in temperate latitudes, or within the tropics only at great elevations; the latter genus is only found in torrid regions. *Ephedra* consists of shrubs of small height, ramifying from the root into numerous divided branchlets resembling those of *Casuarina* or *Equisetum*; these are woody, terete, striated, and divided by articulated nodes, each node being surrounded by a short vaginant sheath cleft more or less deeply into two opposite (more rarely into three equidistant) segments, which form the rudiments of leaves, and it is from the axils of these segments that other branchlets originate. These branchlets are somewhat erect or spreading, and again subdivide in like manner; but the last of them are generally entire, often virgate, though still marked by the usual sheath-bearing nodes, and it is from the latter that the flowers make their appearance. The inflorescence in *Ephedra* is in the form of a short amentiform and often pedicellated spikelet arising out of the nodes just mentioned or at the termination of short axillary branchlets. The flowers are described by authors as either monœcious or diœcious; but in the male spikelets I have generally found, in the terminal involucel between the last two male florets, a single female floret consisting of its own involucel and a small bifid perigonium which encloses two very minute collateral carpels equal to it in length: whether these are the same that produce the fruit, or are sterile ovaries, I have not the means of determining; in either case the spikelets may be said to be polygamo-monœcious. The male spikelet is composed of about six or eight involucels, each of these consisting of two opposite leaflets united at their base into a short vaginant sheath that surrounds the axis; and these involucels, separated by short intervals, are placed decussately over one another, so that the whole assumes the appearance of an amentum of four lines of closely imbricated bracts. Each involucel contains two opposite male florets seated in the axils within these bracteiform leaflets, which are erect, ovate, concave, and of thin texture, but which afterwards grow to a much larger size, and become either scarious or fleshy: each male floret consists of a petaloid perigonium, which is nearly of the length of the involucel, transversely compressed, tubular in its lower moiety, and cleft above into two semiorbicular, erect, concave segments with inflected margins, the posterior lobe overlapping the anterior lobe imbricatively in æstivation; this perigonium is thin in texture, of a pale-yellow or whitish colour, the lower pair of florets becoming caducous before the upper pair open, the persistent leaflets of the involucels increasing gradually at the same time. The stamens are monadelphous, the filaments being united into an erect, flattened, narrow, hollow tube, with nervures corresponding in number to the anthers; it is about half as long again as the perigonium, to the bottom of which it is attached; its exserted summit is flattened, fan-shaped, and of a greenish colour, and bears on the teeth of its margin about six or eight erect crowded anthers, which are sessile or borne upon very short threads; these anthers are subglobular, of a bright-yellow colour, formed of two connate cells separated by a partition without any connective, and opening by two small pores in the apex, which sometimes run into a transverse fissure. The pollen is spindle-shaped, and longitudinally 8-grooved. I know nothing of the structure of the ovary, not having seen a unisexual female spikelet in the flowering state; no one has yet described it, nor do we meet with it in herbarium specimens until the fruit has attained its full size; the spikelet has then the same number of decussating leaflets as the male flowers, all the lower series being empty. At the time I saw the living plants, I was impressed with the idea that the inflorescence in *Ephedra* is monœcious, that the fruit-bearing spikelets are the same as those bearing male flowers, where the persistent involucels have increased in size and many of them grown thicker, and from which the male florets have fallen away, leaving the solitary terminal male flower finally developed into two ripe carpels. I cannot now be certain of this fact, nor will I attempt to contradict the statement of botanists who consider the flowers to be diœcious; but appearances seem to favour my earlier conviction that the flowers are monœcious in the same spikelets, the terminal flower being developed at a much later period, as often occurs in *Euphorbiaceæ*. In support of this idea, it may be remarked that the flowers in the male involucels are developed successively upwards at different periods; so that before the æstivation of the upper florets the lower ones have fallen away, and their bracts have grown to two or three times their former size, thus resembling the empty imbricated involucels always found supporting the terminal pair of achenia in what are considered female spikelets: this fact may be seen in all herbarium specimens. The male flowers are constantly laterally attached, while the solitary female flower always forms the termination of the axis of the spike. The achenia are ellipsoid, sometimes much acuminated at the summit, flat on their contiguous sides, convex externally; each is terminated by a slender tubular style-like process, of about half its length, which has protruded through a small aperture in the summit of the pericarp, left by the permeable sessile stigma of the ovary. The pericarp is somewhat thick, coriaceous, and of a dark-brown colour, the mesocarpal portion consisting of numerous longitudinal ligneous fibres, closely compacted by scalariform tissue and fleshy matter; it is indehiscent, and contains an erect seed, similar in form to, but considerably shorter than its cell. The seed is covered by two integuments, both of which are thin and membranaceous; the outer one (the testa) is of a darker colour, but paler and diaphanous in its upper free moiety, while its lower half is agglutinated to the inner integument and attached by a thickened and almost stipitate chalaza, which is here confounded with the hilum: it is reticulated and devoid of vessels, is shorter than the inner integument (tegmen), which it closely embraces, its mouth being quite unclosed. The tegmen, though free in its upper moiety and partly covered by the free portion of the testa, is conical and much thickened in that part, very opake and white, and often corrugated, being closed in its somewhat attenuated apex by a globular reddish gland ("tuberculus stigmaticus," Rich.), from the concave centre of which rises the tubular style-like process before mentioned, which, after traversing the vacant portion of the cell, passes through the foramen of the pericarp, and generally extends beyond it to a distance of nearly half its length: this process, called a "tubillus," is of the same texture and colour as the upper portion of the tegmen, and is similarly reticulated; so that no doubt can exist that it is an extension of the mouth of that integument, but closed by the formation of a gland at the usual place of the micropyle: the tubillus beyond this is hollow for its whole length, its apex being open and more or less unequally two-lipped. The albumen fills the tegmen, is fleshy, compressed, plano-convex, rounded at its base, but gradually attenuated towards its apex, where it is slender, and sometimes extends beyond the radicle. The enclosed embryo is nearly the length of the albumen, its lower moiety consisting of two compressed cotyledons with nearly straight sides, their faces being parallel to the flat side of the pericarp and to the lobes of the involucel: the radicle, which points to the summit of the carpel, is nearly as long as the cotyledons, but only a quarter of their breadth, being terete, its outer or epirhizal portion being white and opake, while its internal or neorhizal part is fleshy, more pointed, apparently of the same colour and texture as the cotyledons, with which it seems continuous; the epirhizal portion is more cellular, like a distinct envelope, often extending beyond the apex of the neorhiza, which is the growing-point of the future root. In the seed of some species of *Ephedra*, where the summit of the inner integument below the micropylar gland is greatly attenuated, and often so much corrugated that it can be further lengthened by force, the upper portion of the albumen becomes also attenuated, and as it extends beyond the point of the radicle, and contracts an adherence with the gland, it looks almost like a short suspensor; but its texture shows that it is only a continuation of the albuminous mass, there being no trace of anything analogous to the suspensor described by Gaudichaud and Griffiths in *Gnetum.* From the above facts, it will be seen that the seed of *Ephedra* is quite atropous, and (if we except the formation of the tubillus) little different in its entire structure from that of many of the *Urticaceæ.*

I have thus detailed minutely the floral and seminal structure of *Ephedra,* in proof of Blume's declaration that the *Gnetaceæ* possess a much higher degree of organization than any of the so-called Gymnospermous families. This structure of *Ephedra* offers great analogy to that of *Gnetum,* from which it differs in the relative numbers, sizes, and position of the male and female flowers, in the form of its floral envelopes, in the number of its anthers, and in the relative size of the radicle and cotyledons. In *Gnetum* the flowers are arranged in distant nodes, each node consisting of one general, short, cup-shaped involucre, which encircles the stem, and supports two close whorls of numerous florets crowded together, each in a single series, the lower series being composed of female florets, the upper one of male florets: in the female series the perianthium is reduced to lacerated scales that surround each ovary; in the male flowers, which have only a single stamen, each is contained within a 2–4-fid perigonium. I have not seen its fruit and seed, which are minutely described by Griffiths: it grows to a size many times larger than that of *Ephedra,* often attaining the dimensions of a plum, the ovary from which it originated being extremely minute. Analogy shows that each involucel of the spikelet in *Ephedra* is a verticil composed of two opposite bracteiform leaflets standing in front of each perigonium, and which are connate at their base. In *Gnetum,* where, instead of two, more than a score of florets are congregated in each verticil, these bracts become wholly agglutinated together by their margins into an entire cupular and annular general involucre. We find the precise homologues of such gamophyllous involucels in the *Nyctaginaceæ, Thymeleaceæ, Polygonaceæ,* &c.

No one has yet noticed the condition of the ovary of *Ephedra* at the period of its fructification, nor any of the intermediate stages of its growth into a mature seed; nor has any botanist remarked its different gradations in *Gnetum,* except Griffiths, who, in the posthumous memoir before mentioned, minutely detailed this growth. According to that excellent observer*, the production of the tubillus does not commence till after the impregnation of the nucleus, when the micropylar mouth of the tegmen gradually expands and finally becomes elongated into a narrow open tube, which becomes protruded far beyond the apex of the pericarp, as we find it in *Ephedra*; according to his report, there is at first no constriction in this tubillus, which remains unclosed for the purpose of impregnation, but it afterwards becomes sealed up by a distinct deposit and by the adhesion of the base of the tubillus to the tercine or integument formed by the contraction or absorption of the body of the nucleus, within which the albumen becomes deposited*. The various changes that take place during this action (except the lengthening of the micropyle of the secundine) are precisely analogous to those which occur in the fecundation and production of seeds in the higher order of exogenous plants.

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* Linn. Trans. xxii. 301, tab. 55. figs. 18 & 20.

In *Ephedra*, if we look upon its style as being entirely reduced so that its hollow stigma becomes in consequence depressed and fixed in the apex of the ovarium, we have nothing in such a case but a modification of the ordinary pistillum; and under this point of view we have no sound reason for giving the name of *gymnospermous* or naked ovules to the germens of the *Gnetaceæ*. In support of the view thus taken, we find here the female organ in its development following the same changes as in some of the higher orders of dicotyledonous plants; for the nucleus of a single erect ovule grows into a regular embryo, enclosed in albumen, its proper integuments (primine and secundine) finally close over the nucleus, and become the testa and tegmen of the seed, while the shell of the ovarium, in the usual manner of phanerogamous seeds, becomes a coriaceous pericarp formed of ligneous fibres (in *Gnetum* intermixed with peculiar acicular pungent crystals, perhaps analogous to the cystoliths of the *Urticaceæ*).

The only circumstance that has favoured the notion of naked ovules in the *Gnetaceæ* is the absence of a style in the ovary, as just mentioned, and the more immediate impregnation of the ovule, by the entrance of pollinic boyaux through the aperture in its apex, without the intervention of any apparent placentary channels. But a very similar mode of impregnation exists in numerous other families, where the style is hollow for its whole length, leaving a pervious opening into the cell of the ovary: this exists in *Styraceæ*, *Olacaceæ*, and many others. Schleiden figures it in *Helianthemum*†, where several pollinic boyaux are seen descending through the styles into the cell of the ovary, and fixing themselves upon the micropyle of its several ovules. This fact, though not distinctly seen by Brown, was ingeniously inferred by him a long while before‡. Mirbel shows how this is effected in *Statice*§, where a cylindrical process (probably formed of the usual conducting-tissue combined with pollinic boyaux) descends from the united styles through an aperture in the apex of the cell of the ovary, and fixes itself upon the micropyle of the ovule, by which means it becomes fecundated in the same direct manner as in the *Gnetaceæ*. Griffiths also remarks* that he could not detect any conducting-tissue in the wall of the ovarium leading from the stigmata to the base of the cell in *Chenopodium*; he saw distinctly, however, pollinic boyaux attached to the micropyle of its ovule, which could have had no other means of ingress into the cell except directly from the base of the very short style. As before mentioned, we find a similar mode of direct communication between the stigma and the ovules in *Olacaceæ* and *Styraceæ*, where the latter are suspended from a free central placenta, or rather ovuligerous column, the apex of which frequently enters into the broad hollow space in the base of the style; by this means the ovules appear to receive the pollinic influence immediately through the open channel of the style. A similar perforation in the apex of the cell of the ovary into the hollow style is seen in all the *Thymeleaceæ*; and this is manifested in *Cansjera*, where the ovules are fixed on parietal carinal projections, leaving open channels which extend nearly to the summit of the style. Griffiths gives other similar instances in *Santalum*, *Osyris*, and *Loranthus*, where he traced† the pollen-tubes from the stigmata, in a direct course through the style into the cell of the ovary, and in contact with the apex of the embryo-sac in the nucleus of the ovule. It was moreover shown long ago by Endlicher‡, and since confirmed by Dr. Weddel, in his admirable monograph of the *Urticaceæ*, that in that family the micropyle of its basal atropal ovule attains the summit of its 1-locular cell, where it meets with the stigmatic tissue protruding from an opening in the base of the style, and where it becomes firmly attached, as already related of *Statice*. These are cases perfectly analogous to what occurs in the *Gnetaceæ*, and yet no one has ventured to designate the germs so immediately impregnated in those instances as naked or gymnospermous ovules. So likewise in *Piperaceæ*, Schnitzlein has demonstrated§ that the ovary of *Peperomia* has an open channel in its apex contiguous to its sessile stigma, and that the micropyle of its erect atropous ovule is found in immediate proximity to that foramen, exactly as in *Ephedra* and *Gnetum*. In *Myrica*, also, a similar structure exists.

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* *Loc. et tab. cit.* figs. 21, 24, 26.

† Nov. Acta Cæs.-Leop. xix. p. 56, tab. 8. figs. 131–133.

‡ Gen. Remarks, p. 58.

§ Mem. Acad. Inst. ix. 625, tab. 4. figs. 2, 3, 4.

In a paper shortly to be published on South-American *Anacardiaceæ*, it will be shown that in every genus I have examined there is always a pervious aperture in the putamen, whether it be corneous, as in *Rhus*, or thin and fragile, as in *Comocladia*,—whence, from the position of the ovules and the absolute want of any placentary communication between the style and the ovule, we must infer either that the means of fertilization of the latter could only have been conveyed through the spiral vessels of the umbilical cord, according to the long-exploded notions of Adanson and Turpin, or that it took place by the direct action of pollinic boyaux which had found their way to the nucleus through the aperture in the apex of the carpel, somewhat in the same manner as happens in *Gnetaceæ*. As in that paper I have quoted the evidence of St. Hilaire regarding the similar mode of impregnation witnessed by him in *Polygonaceæ*, *Chenopodiaceæ*, and other families, I need do no more than allude to them as additions to the mass of evidence here brought together to show that this mode of ovular impregnation is more general than is supposed.

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* Notulæ, p. 169, pl. 52. figs. 13–20.

† Linn. Trans. xix. 173.

‡ Gen. Plant. p. 283.

§ Iconographia, pl. 81. fig. 17.

In regard to the remarkable growth of the tubillus in the *Gnetaceæ*, I am able to cite two analogous instances in families of a much higher degree of organization, where the mouth of the tegmen is produced into a long tubular expansion, showing that such expansion is in no way connected with the development of what have been held to be naked seeds. I have already demonstrated its production in the tegmen of the seed of *Halesia*, where the summit of that integument becomes contracted into a slender filamentous tube, which appears like a false suspensor, at the radicular extremity of the seed; here, however, the testa closes over it, so that the tubillus, reflected and free, lies between the two integuments*. The other instance is still more striking, and exists in *Tropæolum*, in which genus the production of its tubillus remains to this day an enigma among botanists. The fact of its occurrence was, I believe, first noticed by Gaertner†, and afterwards by St. Hilaire‡, who considered it to be a suspensor analogous to that of *Cycas*, and the channel through which the aura seminalis was conveyed from the funicle for the fecundation of the ovule. Dr. Giraud, in tracing the development of the ovule of *Tropæolum majus*, and the mode of its fertilization by the impact of the pollen-tube upon the apex of the nucleus, confirmed the observations of St. Hilaire in regard to the production of the tubillus at the micropyle of the inner integument§; he also considered this process to be a suspensor like that of *Cycas*, which he regarded as an expansion of the embryo-sac. Schleiden also demonstrates the same fact ‖, and attributes its existence to the same origin. Subsequently, Mr. Wilson * traced the development of the ovule from its earliest stage to the final growth of the seed: but his account is not free from error; for while he admits the great difficulty of discerning the exact limits of the secundine and embryo-sac, he seems to have mistaken the elongation of the one for that of the other, as other observers had done before him. The drawings of Schleiden are certainly more correct than those of the latter botanist, as far as my observations extend. In examining the seeds of four Chilean species of *Tropæolum,* I found that this process is not the embryo-sac, which appears to have been absorbed: it may be seen that the extremity of the radicle is covered by a short tubular cap, which is continuous with the inner seminal integument; this cap is formed by the doubling of the tubillus or lengthened neck of the tegmen; and where this tubillus passes through the foramen of the outer integument, the latter closes round it by means of a glandular deposit †, well represented in Schleiden's figures 124, 125, by the letter *a,* and in Wilson's figure 10 by the letter *k.* This reduplication of the neck of the tubillus is caused by the final growth of the tooth-like wings of the cotyledons, which, extending themselves upwards, conceal the radicle; and we have proof that the process here alluded to is really a reduplication of the tubillus, from the fact that at this part it is of greater opacity, and that when it is immersed in water under the microscope, air-bubbles are clearly discernible between the doubled membrane of the tube. It is certainly not a continuation of the apex of the radicle, as St. Hilaire imagined, and does not offer any degree of analogy to the suspensor of *Cycas*: the extremity of the radicle is defined by a distinct rounded polished point, its apparent suspensor forming a lax covering around its apex. The subjoined figure 1 shows the form of the inner integument, where its mouth becomes extended into a very long neck or tubillus, which at the point of its origin be-

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* Contributions to Botany, i. 169, pl. 31. fig. 23.

† De Fruct. i. 380, tab. 79. fig. 1.

‡ Ann. Mus. xviii. 469.

§ Linn. Trans. xix. 164, tab. 16. figs. 5, 6, 7, 8.

‖ Nov. Act. Acad. Leop. xix. 54, tab. 8. figs. 120–125, p. 56, fig. 126.

Fig. 1.

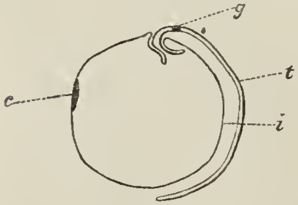
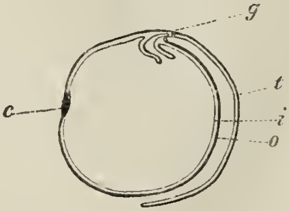


Fig. 2.



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* Lond. Journ. Bot. ii. 628, tab. xx. & xxi.

† This is analogous to the glandular closing of the base of the tubillus in *Ephedra,* which Richard calls a "tuberculum stigmaticum."

comes plicated by the prolongation of the auricles of the cotyledons, thus forming a sort of cap over the point of the radicle: this neck (bearing somewhat the appearance of a suspensor) is the length of half the periphery of the seed, and is reflected downwards from the vertex along the dorsal side, where it lies tightly pressed, but free, between the testa and pericarp: the glandular deposit marked *g* closes the integuments at the point where the tubillus (*t*) passes through the foramen of the testa: the position of the chalaza is shown at *c* (near the base of the free portion of the style, and where it is confounded with the hilum). It will hence be seen that the integuments are atropous (not anatropous, as generally believed), while the embryo, from its very excentric growth, lies amphitropously in regard to them*. In figure 2 is seen the same inner integument as in the preceding figure, where it is marked *i*, to which is added the outer integument, or testa, marked *o*, the mouth being closed by the gland *g*, which also forms a stricture in the neck of the tubillus. The analogy of this development with that I have described in *Ephedra* is very manifest.

I have not been able to find in the seeds of *Ephedra* any indication of the long spiral suspensor which in *Gnetum* is described as being coiled up in the summit of the albumen, and there attached to the embryo. The nature of this suspensor has not yet been precisely ascertained: it is figured and described by both Gaudichaud † and Griffiths ‡, the former from an analysis of Aublet's Guiana plant, the latter from the examination of two Indian species: there is a considerable difference in the details of these analyses, which admit of conciliation. Its existence in the earliest stage is shown by Gaudichaud (*loc. cit.* tab. 1. fig. 14), where a number of distinct, loose, slender, inarticulate tubes are seen in the summit of the nucleus, which he conceived to be either "very elongated cells" or "embryo-bearing pollen-tubes" (*loc. cit.* p. 54). The next state is represented in pl. 6. fig. 40, when it seems like a long spiral cord in the cavity of the albumen, bearing a very young embryo. Afterwards (in figs. 41 & 42) it appears like a broad cylinder, consisting of the former suspensor, now filled with and surrounded by cellular tissue; and he conceived § that it was formed by a combination of all the first-mentioned sterile embryoniferous threads. Finally (in fig. 43), we see the same apparent cylinder separating by the application of force into a spiral cord, formed of "des sortes de vaisseaux fasciculés rameux et tissu cellulaire." Griffiths says of it (*loc. cit.* p. 304), "to the upper portion and to one side of the cavity (in the albumen) is attached the embryo by means of an enormously long, tortuous, and spirally but irregularly twisted cellular funiculus, the cells being very much elongated and twisted; its length varies, when moderately pulled out, from 3½ to 5 inches, the length of the fruit being 1 inch. This funiculus, as well as the extremely similar one in *Cycas*, has the property of contracting when immersed in water; when *in situ*, it is tolerably closely packed: it is dilated towards its attachment with the embryo."

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* It would involve too long a digression to describe here the very anomalous seminal structure of *Tropæolum*, which has been altogether misunderstood.

† Rech. Organ. p. 76, tab. 1. fig. 14; tab. 6. figs. 40–43.

‡ Linn. Trans. xxii. 304–308, pl. 56. figs. 30–37.

§ "Il est à croire que tous ces cordons stériles (pl. 1. fig. 14) font parties de ce cordon suspenseur."

From Gaudichaud's account we may infer that this suspensor is composed of cellular tissue loosely compacted round bundles of very elongated pollen-tubes which become spirally twisted into a hollow cylinder, moulded into the size and shape of a cavity of the albumen. Griffiths's drawing seems to confirm this; for when drawn out into a spiral thread, it appears like a bundle of such tubes. From its absence in Brongniart's elaborate analysis of *Gnetum Gnemon**, we may infer that it is not a constant or essential feature in the organization of the seed. Roxburgh, who minutely describes the structure of the embryo in two species of *Gnetum*, makes no mention of any such suspensor; and Griffiths affirms the "very rare and partial development of the funiculus;" for, after examining abundance of fully-formed fruits of two species, he found only two instances where its partial formation, it lying loose in the cavity of the albumen, was observable (*loc. cit.* p. 302). Some additional light will be thrown on this subject in the following remarks.

It has been the general opinion of botanists that the *Gnetaceæ* are intimately allied to the *Coniferæ* and *Cycadaceæ*, some inclining to their affinity with the former, others to the latter group, which two families are placed by Endlicher widely apart in his systematic arrangement; while others, again, congregate the three families into one class, *Gymnosperms* or *Gymnogens*. The principal argument in support of the relation to *Coniferæ* has been founded on the assumption that in the *Gnetaceæ* the seeds are naked—a doctrine which, it appears to me, ought never to have been applied to this family. In other respects there is no analogy; for the *Coniferæ* have a very different habit and another system of inflorescence, which is amentaceous, with achlamydeous flowers and pistils generated upon the under side, or on the margin of phylloidal bracts, forming altogether a development of the lowest grade among dicotyledonous plants. In *Ephedra*, on the contrary, we have regular spikelets of flowers, though small, consisting of opposite decussating involucels, with a perfect petaloid perigonium seated on each axil. There is absolutely no parallelism in the organization of these two families. Most botanists have considered the position of the *Gnetaceæ* among *Gymnosperms* to be close to *Taxineæ* (a suborder of *Coniferæ*). In *Taxus*, however, if we consider the outer coating of its pistil to be a carpel, which grows into an osseous shell, then its ovule is perfectly devoid of any integumentary envelope, as in *Pinus*, and in like manner it produces a perfectly naked seed*; and, according to the masterly analyses of *Taxus* by Mirbel and Spach†, the facts of which have been confirmed by Schleiden, its ovule has constantly three foramina in its apex, leading into as many embryoniferous cavities in the amnios, after the manner of other true *Coniferæ*. This is perfectly at variance with all that we find in the *Gnetaceæ*.

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* Voy. Coq., Bot. vol. ii. tab. i. figs. 6, 7, 8, 9, 10, 13, 14, 15.

With the *Cycadaceæ* the dissimilarity in these respects is still more striking. The existence, however, of a suspensor in its seeds has greatly favoured the idea of the close affinity of *Gnetum* with this family: the coincidence is unquestionable; but this circumstance is of little import upon its own merit, for we may conceive the possibility of its occurrence, as we find it in *Gnetum*, in any family of the highest order of development. The growth and structure of the seed in *Cycadaceæ*, as demonstrated by Miquel‡, present many peculiarities of which we have no parallel in the *Gnetaceæ*. If we regard in its proper light the outer covering of the pistil, and the thick fleshy and coriaceous shell of the seeds of the *Cycadaceæ* to be the growth of a true carpel, it will be evident that the erect nucleus enclosed within the pistil and the seed contained within the carpel are deficient of any proper integument; and under this point of view both may be considered to be perfectly naked—a condition widely different from that of the *Gnetaceæ*, where both the ovule and seed are covered by two distinct integuments. Miquel, who considered the pericarpial covering of the fruit to be the testa of the seed lined with an adherent inner integument, notices that the latter in its early stage is crowned by a broad areolar callus, which he calls its chalaza; this is marked by a circular ring of perforations, which open into as many small cavities, in each of which is generated a distinct thread, coiled up and bearing at its lower extremity an embryo-sac: all these sacs descend into the amniotic body, where only one of them is fertilized; this fertilized sac finds its way out of the amnios into the body of the nucleus and becomes an embryo, when a mass of albumen is generated around it, which completely encases it, pushing upwards in its growth the persistent amnios, which, like a vitellus, remains as a sort of cap upon the albumen. When the seeds attain maturity, the thread of the fertile embryo, as well as the several filaments still bearing their sterile sacs, all having descended into the vitellus, there become twisted together and surrounded by lax cellular tissue, thus forming the suspensor. This development is clearly shown in its several stages *loc. cit.* pl. 8. figs. 3, 5, 15, 16, 21, 26. After the perfection of the embryo within the albumen, the radicle grows upward, as if germinating, and, forcing a passage through the vitellus, finds an exit by the side of the attachment of its own suspensorial thread, and remains there naked and quite distinct from the main suspensor (as shown in fig. 17)—a fact claiming our especial notice, as it is a condition very different from what Griffiths and Gaudichaud show of the suspensor in *Gnetum*, where the amnios, having been altogether absorbed, the suspensor appears continuous with the radicular extremity of the embryo. In regard to the nature and origin of the several threads (which together form the suspensor), Miquel was evidently inclined towards the notion that they are the pollen-tubes, which had penetrated the several embryo-sacs, becoming afterwards agglutinated together by lax cellular tissue into one general twisted cord: this is certainly the only legitimate inference from all the circumstances recorded, in support of which Griffiths relates (*loc. cit.* p. 306) that he always found in *Cycas* that "the tubular membranous portion of the apex of the nucleus becomes actually crammed with pollen-granules, from the lower and outer of which pollen-tubes are pretty generally produced."

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* From the analysis of *Torreya taxifolia*, as given by Sir Wm. Hooker (Icon. 232, 233), it would seem that its carpel is at first pervious at its summit, and is furnished with an erect atropous ovule, provided with two very distinct free integuments, of which the primine afterwards becomes agglutinated to the carpel in the fruit, while the secundine remains coherent with and enters deeply into the plicatures of the ruminated albumen. Should this analysis of the ovary be confirmed, it would show that *Torreya* cannot belong to *Taxineæ*, but is more allied to *Myricaceæ*.

† Ann. Sc. Nat. 2 sér. xx. 257.

‡ Ann. Sc. Nat. 3 sér. iii. 193, pl. 8.

Changes very similar in their nature take place in the production and growth of the suspensor in the *Coniferæ*, the several stages of which were clearly described and figured by Brown two years prior to the publication of Miquel's researches on *Cycadaceæ*; and the singular coincidence of these developments is a strong argument in favour of the near affinity of these two families. Brown showed that, in *Pinus** (which, like *Cycas*, is always polyembryonous), previous to the development of the several embryo-sacs and their suspending threads, the former are constantly first discernible in distinct areolar cells in the nucleus, arranged, as in *Cycas*, in a circular series in the summit of the amniotic body: these sacs descend, each separately suspended by its own elongated thread; but generally only one of them becomes fertilized. The further progress of this growth, and the increment of the embryo, which becomes surrounded by an albuminous mass that pushes upward the amniotic body, and remains persistent on it like a calyptriform cap, is quite analogous to the growth described by Miquel in *Cycadaceæ*, and very different from that of *Gnetum*. It is remarked by Brown that each suspending thread appears formed of about four simple tubes connected together but slightly, for he found them easily separable from one another without laceration of their surfaces; and this fact gives additional force to the conclusion before mentioned regarding the nature and origin of the suspensor. Still further evidence is given by Schleiden, who traced the entrance of pollen-tubes into the areolar cavities before described, and into the embryo-sacs, with which they remained permanently connected. The growth and development of these several embryo-sacs in each ovule, and their attachment to suspending threads in *Pinus*, *Thuja*, and *Taxus*, are minutely described and figured in the interesting researches of Mirbel and Spach*, published about the same time, and confirming all the observations of Brown: they describe also each suspending thread as being formed of five or six boyaux or simple tubes agglutinated together, each being hollow and filled with granular fluid or such fovillæ as are usually found in the boyaux of pollen.

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* Ann. Sc. Nat. 2 sér. xx. p. 195, pl. 5; Ann. Nat. Hist. xiii. 368, pl. 7.

It has been the opinion of many botanists that the existence of annularly dotted vessels in the wood of the *Gnetaceæ* affords evidence of their close affinity with the *Coniferæ*; but even if this had been true, it would have claimed, on its own merit, a very secondary importance, since we find such vessels also in the *Winteraceæ*, *Canellaceæ*, *Schizandraceæ*, &c. Dr. Lindley says of *Gnetum* that its wood "is composed of woody fibres and of annular and reticulated vessels lying scattered sparingly among tubes of woody fibre"†. He says also that its wood is zoneless. These circumstances led that eminent botanist to conclude that the *Gnetaceæ* are very distinct from the *Coniferæ*, forming a link between *Taxineæ* and *Piperaceæ*: this, at least, was his opinion in 1834, although other considerations induced him afterwards to modify his view of the place of this small family in the system. I have noticed, however, that the wood of *Ephedra* is regularly zoned, as in other exogenous plants; for a transverse section of a branch of *Ephedra Andina* which I possess shows five distinct concentric rings, the intervals between the medullary rays exhibiting numerous longitudinal hollow air-cells. The branches of *Gnetum*, on becoming dry, separate readily at the nodes by distinct articulations; but such separation rarely takes place in *Ephedra*. On the other hand, a longitudinal section of a new branch of the latter genus shows that the central pith of one internode is not continuous with the pith of the next internode, nor with that of their accessory branchlets; for the ligneous fibres of the several internodes which enclose the pith, and which constitute the wood, all converge to form a sort of plexus or solid diaphragm across each node, much after the manner of the stem of a *Bambusa*.

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* Ann. Sc. Nat. 2 sér. xix. pl. 8, 9, 10, 11.

† Bot. Reg. vol. xx. pl. 1686.

This pith is quite homogeneous, consisting of oblong, square, parallel cells (hexagonal in their transverse section), with very thin transparent walls, which are pitted with few, minute, opake dots. The wood is hard, formed of fine, simple, indurated fibrous tissue, closely compacted; these longitudinal fibres, under a powerful microscope, appear marked by dark glands lying across them at irregular distances, which are either transversely linear or oblong, thus giving them almost a scalariform appearance, the walls themselves being pitted with minute and almost invisible specks; these are crossed by very numerous transverse medullary rays of similar structure, which extend from the pith to the bark. In the first two or three rows of the longitudinal fibres or ducts next the pith, the markings are so very close that they have much the appearance of uncoilable tracheæ; but I have nowhere been able to find any true spiral vessels. Interspersed among the longitudinal woody fibres, are the many hollow air-tubes before mentioned, of three or four times their diameter, which appear uninterrupted throughout the entire length of the internode: their walls are extremely thin and translucent; and it is upon these only that we find the large circular spots (apparently fenestrations), which are well shown in Lindley's 'Introduction,' pl. 2. fig. 7. It will hence be seen that there is no analogy between this structure and that of the *Coniferæ*, where the annular disks, which so conspicuously mark the Gymnospermous families, are always found upon the ligneous fibres themselves, and not upon the air-passages, as in *Ephedra*. The structure is equally different from that of the young branchlets of *Casuarina*, where the pith crosses the nodes and is continuous throughout the branches.

There is a peculiarity in the bark of *Ephedra* that may be worth recording: it is filled with strong ligneous fibres, as in

Urticaceæ, which, being always united in bundles, give rise to its finely striated surface; it is covered by a thick, tough epidermis, of the texture of parchment, and which follows the sinuosities of the striatures. Upon the ridges of the striæ a number of prominent horny excrescences occur, which occasion its scabridity; and in the hollows between the ridges are seen a number of black longitudinal specks, which appear almost like stomata that have become closed by a deposit.

Thus far it has been endeavoured to show that the order *Gnetaceæ* is not allied to any of the Gymnospermous families, with which it has been associated by most botanists. It will now be necessary to pass in review the points of analogy that exist between it and other exogenous orders, in order to judge of its true affinities.

Blume, when he founded the order, as before stated, suggested the relationship of the *Gnetaceæ* with *Casuarina*, to which genus it certainly offers many points of approximation. *Casuarina* resembles *Ephedra* in the following particulars:—in the vaginant sheaths that encircle the nodes of its branchlets, where they occupy the place of leaves; in its spicated inflorescence, with diclinous flowers; in the persistence of the involucral leaflets, which afterwards enclose the fruits; in its bifid perigonium, even more deciduous than that of *Ephedra*, for it is carried away by the stamen as it grows upward in the act of æstivation; in its solitary stamen, very analogous to that of *Gnetum*; in its one-celled ovary, with an ascending ovule; and in its indehiscent one-celled fruit, with a single erect seed, containing an embryo imbedded in albumen, with a superior radicle. *Casuarina*, however, differs from both *Gnetum* and *Ephedra* in its straight, lofty, solid, woody trunk; in its ovary with two lengthened styles (being probably formed normally of two combined carpels, one of which is always abortive, and which contains two ovules); in its fruit, with a samariform epicarp, a mesocarp replete with very numerous delicate spiral vessels, and a solid testaceous endocarp; and, finally, in the development of its seed, the anomalous circumstances attendant on which have been only imperfectly understood*.

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* I have examined the seeds of *Casuarina equisetifolia* many times, always with the same result; and as my analysis shows a structure very different from what is recorded of it, I will state the details. The description given by Endlicher of this structure (Gen. Plant. p. 271) is altogether incorrect. It is well known that the fruits are contained in globular or oblong strobiliform heads, each separate fruit being enclosed in a cell formed of two coriaceous valves, which are the persistent involucels of the spicated flowers, which valves stand right and left in regard to the axis. Each fruit is fixed to the bottom of its enclosure by a small basal hilum: it is somewhat samariform, oblong and compressed; the upper moiety (being a portion of the extended epicarp) forms a thin membranaceous

With the *Myricaceæ, Ephedra* agrees in many points of structure, the most prominent of which are, its diclinous flowers in amentiform spikelets; its bract-like involucels; its two-lobed perigonium; its monadelphous stamens; its simple ovary, with a single, erect, atropous ovule; its one-celled fruit, with a solitary erect seed; and its embryo with a superior radicle. *Myrica* differs, however, in its habit; its alternate leaves; its perigonium in the form of two hypogynous scales, which remain and become agglutinated to the fruit; in its more distinct stamens, with anthers bursting longitudinally; in its two stigmata; and in the want of albumen in the seed. Although these points show a considerable interval in the positions of these two families, it is still evident that a notable degree of approximation exists between the *Gnetaceæ* and *Myricaceæ*.

The *Gnetaceæ,* in their jointed stems and floral structure, offer many points of approach to the *Chloranthaceæ, Piperaceæ,* and *Saururaceæ;* but the absence or depauperation of floral envelopes in those families, and the presence of a vitellus or embryoniferous process which surmounts the albumen, of which we find no trace either in *Gnetum* or *Ephedra,* are features which well characterize the above families as a peculiar group, having little connexion with the *Gnetaceæ*.

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wing; the lower moiety is thickened and smooth, consisting of an intermediate mesocarp filled with copious, white, spiral threads, and a testaceous, brittle, obpyriform endocarp, completely 1-celled and indehiscent, and containing a single erect seed, which tapers to the apex. This seed consists of two very delicate translucent membranaceous tunics: upon the outer one (testa) is seen, imbedded in it, a thickened simple cord (raphe), by one extremity of which the seed is attached to the bottom of the cell; this cord rises to near the middle of the integument, when it becomes suddenly recurved downward for a short distance, where it terminates in a darkish areole (chalaza); before its recurvature it throws out a short lateral branch or free thread, which serves as the medium of attachment of an abortive ovule at a point a little above its base, where this also is recurved upon its basal chalaza. The abortive ovule, tapering upwards, is nearly half the length of the fertile seed to which it is thus attached; it is delicately membranaceous, darkish brown, without the trace of any embryo within it. Upon the outer integument of the fertile seed, the white cord continues to ascend from the point of its furcature, and terminates in the apical micropyle, which is much darkened. There is no trace of any albumen within the integuments; and the contained embryo, which is not half their length, floats loosely in the upper part of the vacant space, generally with the radicle pointing to the micropyle, or at other times lying obliquely across the vacant space. The cotyledons are oval, flattened, and foliaceous, with a superior terete radicle of about half their length.

It will be seen that there is very little analogy in the whole of this singular structure to *Ephedra*; and although the orthotropous embryo lies atropously in regard to the hilum, it is amphitropous in respect to the chalaza.

Excepting their amentiform diclinous inflorescence, there is nothing in the structure of the *Betulaceæ, Cupuliferæ, Artocarpeæ,* and other consociate families, that offers any relation with the *Gnetaceæ.*

In its aphyllous habit, its geniculated nodes, and vaginant bracts in lieu of leaves, *Ephedra* presents some similitude to *Calligonum, Pterococcus,* and *Calliphysa,* with which it accords also in its tubular petaloid perigonium, seated in the axils of a general involucre—thus approaching the structure of the *Eriogoneæ,* and more particularly that of *Chorizanthus vaginatus,* which has its stems furnished with opposite bracteiform leaflets united into a membranaceous sheath, as in *Ephedra.* The *Polygonaceæ* generally, indeed, agree with the *Gnetaceæ* in their often polygamo-monœcious or diœcious flowers, in their calycinoid involucres; their petaloid perigonium; their stamens often monadelphous at the base; their usually one-celled ovary, with a single erect ovule, which (as I have shown) becomes fertilized, in the same manner as in the *Gnetaceæ,* by the direct influence of the pollen through an aperture in the apex of the cell, without the intervention of a placenta; and, finally, in their indehiscent one-celled fruit, bearing a single erect albuminous seed, covered by two regular integuments, and enclosing an embryo with a superior radicle. However remarkable these analogies may be, which are in many respects shared with the *Nyctaginaceæ,* it is impossible to place the *Gnetaceæ* in a position near these families and their allies; for the *Oleraceæ* of Endlicher form a most distinct and natural group, well characterized by the peculiar feature of a curved embryo placed outside of a farinaceous albumen.

Although the relationship of the *Gnetaceæ* with the *Urticaceæ* may not at first sight be apparent, still in many very essential points an analogy exists, which is well deserving of attention. The flowers in *Urticaceæ* are often diclinous, and in bracteated spikelets. It has been shown (*ante,* p. 146) that their solitary carpel, sometimes wanting a style, with sessile stigmata, has a pervious opening in the apex of its cell, through which the solitary erect ovule is directly fecundated by the pollen, without the intervention of any placenta. This erect ovule is always atropous, with two distinct integuments; and its embryo, with a small superior radicle, is enclosed in fleshy albumen. In these remarkable particulars I know of no other order that so nearly approaches the *Gnetaceæ.* On the other hand, the *Urticaceæ* are very different in habit—in their usually (but not always) alternate leaves, in the form of their inflorescence, and in the structure of the male flowers; in the latter respect, however, a degree of analogy remains, for it generally happens in these, as in *Ephedra,* that the lobes of the perigonium are opposite to those of the involucels. We find also in the inner bark of *Ephedra,* strong fibres almost as abundantly as in the *Urticaceæ*: another similar development invariably occurs in that genus, in the vaginant stipulary leaves that surround each branchlet, at the point of its origin in the axils. There is some approach in the floral structure of the *Gnetaceæ* to that of the *Urticaceæ*; that is to say, it is in both cases diclinous, the male flower in both families presenting a gamophyllous perigonium seated generally in its own involucel, or occasionally several perigonia within involucels more or less confluent with each other. It is true that in *Urticaceæ* the perigonium is often 4- or 5-partite, but it is sometimes 2- or 3-fid, with equal segments; the insertion of the stamens is invariably at the base of the tubular portion of the perigonium, as in *Ephedra,* and often the filaments are monadelphously conjoined at their base. In the tribe *Forskohleæ* the involucels of the flowers are combined into an annular cup, as in *Gnetum*; sometimes two involucels, united at the base, contain one or two florets, and then the solitary stamen is fixed in the base of the perigonial tube, without any vestige of an ovary, as in *Gnetum.* I have stated these numerous points of coincidence in order to show that, when we take into consideration the sum of their characters respectively, a greater approximation will be found to exist between these two families than has been imagined: in the present imperfect state of our knowledge, their juxtaposition in the system cannot be safely established; for the *Gnetaceæ* require a more careful examination. Much additional information may be expected from the promised description, by Dr. Hooker, of the new and curious genus *Welwitschia,* which, I have no doubt, will tend greatly to elucidate the question of the true affinities of this family.

Meyer has classed the different species of *Ephedra* in two sections,—the one, *Plagiostoma,* where the summit of the tubillus is obliquely ligulated or unequally two-lobed; the other, *Discostoma,* where it is truncated or enlarged in the form of a disk, the latter section comprising only two species, which are of South-American origin, *E. Tweediana* and *E. americana.* On referring to his drawing of the former species (Mem. Acad. St. Petersb. tom. v. pl. 7. fig. 9), we find there a representation of this tubillus, marked H, which shows no approach whatever to a disciform shape; and in regard to the latter species, which Meyer does not appear to have seen, Kunth describes its tubillus as he conceived it to be, a "stylus subulatus exsertus, stigma simplex;" and Richard defines the same as "rectus, tubulosus, ostiolo oblique sub-4-lobo." In all the specimens of *E. Tweediana* that I have seen, especially in those collected by myself, the tubillus is straight, in no degree enlarged at the apex, and generally lacerated; but, when uninjured, I have found it shortly 2-fid, with two small erect rounded lobes, differing in no respect from what is observable in his section *Plagiostoma.* I therefore consider that such a division of the genus, founded upon the character assumed, is not maintainable.

I have expressed a doubt (*ante,* p. 142) of the truth of the general belief that in *Ephedra* the flowers are diœcious, that is to say, that the male and female flowers are always upon distinct plants. I have stated the impression entertained by me when in Chile, that both sexes exist on the same plant, if not in the same spikelets: in support of this, my drawing of *Ephedra bracteata,* made nearly forty years ago, showed fruits upon one of the lower branchlets, while all the upper ones exhibited male flowers only; but I was unwilling to place much reliance on that circumstance at this distance of time, as all my specimens were lost. I have, however, lately noticed a confirmation of this fact in a specimen, now existing in the Hookerian herbarium, of the same species, where most of the ramifications have their floral branchlets terminated by ripe fruits, while in a lower part is another branchlet charged with a spikelet of male flowers. Kunth also corroborates a similar occurrence in *Ephedra americana*: in that species, he states that each axil produces a cluster of four spikelets, three of which consist of male florets, while the other contains two female flowers; for he adopted the view of Richard in considering the pericarp of each achenium as the indurated perigonium, and the enclosed seed with its tubillus as the ovary surmounted by its style. It is still a matter of doubt whether the two achenia generally associated in the apex of a spikelet are produced from one or two florets. I am inclined to think the latter, because it is more in analogy with the position of the male florets. Meyer describes four species from Southern Europe and Mauritania, where the fruit is constantly solitary in each spikelet: this, perhaps, is merely the result of the abortion of one of the florets.

Careful observations on the progressive growth of the plants, made in their living state, are required to clear up these several doubts, and to complete the history of *Ephedra.* The following diagnosis of the genus is based wholly upon my own observations of the South-American species here described.

Ephedra, Tournef.—*Flores* unisexuales; sed dubitandum est, si sexus singuli in diversis plantis, vel in diversis ramis, vel in eadem spica orti sint: certissime ♂ in axillis spicarum enati, mox decidui, ♀ semper terminales et forsan in eadem spica tardius oriundi.—*Flores* ♂ in spica amentiformi imbricato-involucrata plurimi; *involucellum* singulum bracteiforme imo

cum opposito in vaginam brevem coalitum, ovatum, erectum; involucella hoc modo per paria nexa, decussatim imbricata et 4-faria, singula 1-flora. *Perigonium* intra quodque involucellum unicum, e basi ortum, petaloideum, coloratum, turbinato-tubulosum, compressum, limbo 2-labiato, labiis (antico et postico) rotundatis, æstivatione imbricatis, posteriore exteriore, mox deciduum. *Stamina* monadelpha, cum perigonio decadentia; *filamenta* in columnam fistulosam compressam apice dentatam aut breviter fissam perigonio æquilongam vel longiorem connata; *antheræ* 3 ad 12, tubi dentibus vel filis brevissimis crebriter basifixæ, ovatæ vel oblongæ, erectæ, 2-lobæ, 2-locellatæ (lobis sine connectivo collateraliter adnatis), poris 2 apicalibus rarissime transversim connexis dehiscentes. *Pollen* globosum, vel ellipticum, 8-sulcatum. *Ovarii* vestigium nullum.—*Florum* ♀ partes ignotæ. *Achenia* 2 distincta, rarius solitaria, summo spicæ amentiformis (ei ♂ similis) affixa, involucellis omnino vel semi-inclusa, oblonga, subcompressa, plano-convexa, collateralia, erecta. *Pericarpium* siccum, coriaceum, glaberrimum (*mesocarpio* fibrillifero), indehiscens, apice glandulæforme pro tubilli transitu pervium, uniloculare. *Semen* unicum, basi affixum, loculo paulo brevius, apice acutum; *integumenta* 2, simplicia, ab imo usque ad medium coalita et membranacea, dehinc superne libera et distincta; *testa* tegmine valde brevior, ore lato aperta; *tegmen* superne opacius, crassius, sæpe corrugatum, apice glandula carnosa majuscula clausum; *tubillus* e centro glandulæ productus, erectus, elongatus, per foramen pericarpii prolatus, et sæpe longe exsertus, filiformis, teres, fistuloso-membranaceus, persistens, apice irregulariter laceratus aut breviter 2-labiatus, labiis aut brevibus concavis et subæqualibus, aut inconstanter inæqualibus; *hilum* cum *chalaza* basali confusum, substipitatum; *raphe* nulla; *albumen* oblongum, compressum, obpyriforme, carnosulum, apice ad glandulam adhærens, embryone paulo longius; *cotyledones* oblongæ, compressæ, subfoliaceæ; *radicula* teres, supera, hilo contraria, cotyledonibus æquilonga vel dimidio brevior et earum sexta parte latitudinis.

Suffrutices *cosmopolitani, e basi ramosissimi, erecti, humifusi vel alte scandentes*; ramulis *teneribus, sæpius virgatis, oppositis, ternis, aut fasciculatis, in axillis nodosis*; folia rudimentaria 2, *opposita, vel plura, primum in vaginam brevem amplexicaulem apice 2–3–4-fissam coalita, demum sæpe disjuncta*; flores *parvi, spicati*; spicæ *parvulæ, in axillis sessiles, solitariæ, binæ aut plures glomeratæ,* vel in ramulum *brevem terminantes,* involucellis *viridibus,* perigonio *sæpius aurantiaco,* columna staminali *viridescente,* antheris *læte flavis.*

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Careful observations on the progressive growth of the plants, made in their living state, are required to clear up these several doubts, and to complete the history of *Ephedra.* The following diagnosis of the genus is based wholly upon my own observations of the South-American species here described.

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Suffrutices *cosmopolitani, e basi ramosissimi, erecti, humifusi vel alte scandentes*; ramulis *teneribus, sæpius virgatis, oppositis, ternis, aut fasciculatis, in axillis nodosis*; folia rudimentaria 2, *opposita, vel plura, primum in vaginam brevem amplexicaulem apice 2–3–4-fissam coalita, demum sæpe disjuncta;* flores *parvi, spicati;* spicæ *parvulæ, in axillis sessiles, solitariæ, binæ aut plures glomeratæ,* vel in ramulum *brevem terminantes,* involucellis *viridibus,* perigonio *sæpius aurantiaco,* columna staminali *viridescente,* antheris *læte flavis.*

Since the foregoing portion was printed, Dr. Hooker's memoir on *Welwitschia* has appeared in the Linnean Transactions, which renders it incumbent on me to reconsider my former views concerning *Ephedra*. That memoir will claim attention from every botanist, not only for the careful description of the structure of this remarkable plant, but for the admirable manner in which the elaborate details of its analyses are illustrated; and it is fortunate for science that Dr. Hooker had at his command ample materials for the investigation. For the present purpose it will be necessary to refer only to such points in that memoir as may relate to *Ephedra*.

In the absence of the smallest information concerning the female flower and the ovary of *Ephedra*, and with the knowledge that in *Gnetum* the male and female flowers are found in distinct whorls on the same node, I had suggested the possibility that in *Ephedra* both sexes might prove to be developed in the same common spikelet, in which the male flowers in the lower whorls had fallen away before the female flowers became developed in the terminal whorl—a supposition rendered more probable by the fact that male and fructiferous spikelets are sometimes found on the same plant. But the changes shown in the gradual development of the ovary and fruit of *Welwitschia* render the above supposition improbable; and by analogy we may now form a tolerable conjecture of the nature of the female flower in *Ephedra*. From these data we may infer that the two ovaria developed in the terminal pair of involucels are deficient of a corolla—a circumstance which sometimes occurs in *Euphorbiaceæ*, where the male flowers are provided with both calyx and corolla, while the ovary is destitute of any floral envelope.

The application of the term "cone" to the flowering heads of *Welwitschia* and *Ephedra* is calculated to mislead many persons in regard to the affinity of the *Gnetaceæ*; for they bear little analogy to the cones of the *Coniferæ*. They are more properly spikelets, because they bear regular petaloid sessile flowers along a common axis, much after the manner of a spike of *Plantago*; and they offer more claims to this category than the spikelets of *Myrica*, the aments of *Betula*, or the spicated inflorescence of many other genera.

The structure of the male flowers and the mode of inflorescence in *Welwitschia* present a striking resemblance to those in *Ephedra*, both showing an advanced state of floral development. Dr. Hooker considers the ovule in the female flower to be deficient of any carpellary covering, and therefore gymnospermous; but the circumstances he has demonstrated tend rather to evince that it is enveloped in a distinct carpel. The important fact of the existence of hermaphrodite or polygamous flowers in this family serves to throw much light on this point. It is shown in pl. 6. fig. 14 that *Welwitschia* (besides its floral envelopes) presents a monadelphous ring of regularly formed stamens surrounding an ovary constituted in the usual manner of angiospermous plants—that is to say, with a simple style and stigma surmounting an oblong 1-celled carpel containing a single erect ovule, thus exhibiting a floral development and pointing to a position in the system far higher than the gymnospermous orders of *Coniferæ* and *Cycadaceæ.* But the ovule of the hermaphrodite flower is always sterile, and it is only in such flowers as are deficient of corolla and stamens that embryo-sacs are formed in the ovule which admit of its fertilization; and here it is seen that the style becomes so far depressed that the stigma remains sessile on the summit of the carpel, leaving the small apical pervious aperture constantly found in the fruits of *Welwitschia* and its congeners. This depression of a pervious stigma I have shown to exist in several other instances. The entire development imparts a truly angiospermous character to the *Gnetaceæ,* notwithstanding the pervious aperture in the carpel, while the peculiar mode of fertilization, as Dr. Hooker seems to indicate, is analogous to some instances in *Santalaceæ* and *Loranthaceæ.* I long ago pointed out the existence of vascular threads in the viscous cap which crowns the seed in *Loranthus* (*Struthanthus*), the nature of which I did not then understand, but which may perhaps be analogous to the development shown in *Welwitschia.*

The involucels in *Ephedra,* even in a young state, resemble those of *Welwitschia* in this particular—that the margins are simply reticulated and petaloid, while the central discoid portion is formed of three easily separable laminæ, the external plates being simply reticulated and epidermoid, while the inner lamina consists of numerous closely disposed spicular fibres shaped like those shown in *Welwitschia*; these are imbedded in parenchyma, as well as two conspicuous distant and parallel nervures which consist of bundles of ordinary spiral vessels.

The bilabiate perigonium in *Ephedra* is quite reticulated and petaloid, and exhibits no trace of any similar fibres or vessels.

Its achenium bears all the usual features resulting from the growth of a regular carpel: it is thick and coriaceous, containing within its somewhat fleshy mesoderm a number of long hair-like threads of pellucid woody fibres, nearly of its entire length; there is no resemblance in this structure to the perianth of the male flowers. Dr. Hooker, however, considers the similar pericarp of *Welwitschia* to be the growth of a perianth surrounding a gymnospermous ovule deficient of any true carpellary covering —a conclusion apparently formed upon hypothetical grounds.

I have to make an essential correction in regard to the tubillus: from recent examinations of the seeds of *Ephedra dumosa* (in which the seminal integuments are somewhat thicker) and of immature seeds of *E. Americana,* lately obtained, it is seen that the tubillus is expanded below, like an inverted funnel, quite free from the apical gland, which it surrounds, and is continuous with the outer integument, of which it is a simple extension. In the cases previously observed, this dilated portion was so extremely delicate, and adhered so closely to the gland, that the tubillus seemed to rise out of it. The fact, as above stated, is now beyond all doubt.

I have again examined carefully the suspensor in *Ephedra,* but can discover no trace of those embryo-sac-bearing filaments which are found in *Gnetum* and *Welwitschia.* The tubillus, as above stated, is a prolongation of the outer integument; the red fleshy gland is attached to and closes the mouth of the inner integument. To a small point in the centre of this gland is attached the white cylindrical and tubular suspensor, hemispherical at its apex, the lower extremity of which descends upon and adheres firmly to the upper part of the albumen, thus forming a kind of white cap upon it for a quarter of its length. This suspensor is capable of considerable extension; and when cut open along one side and examined under the microscope, it is found to consist of a loose mass of condensed and extremely fine flocculent tissue, confusedly huddled together like paper-pulp, without the slightest trace of any of the coiled filaments seen in *Welwitschia* and *Gnetum,* or any vessels whatever. The albuminous mass is just the length of the embryo, and does not extend over the summit of the radicle, which is quite naked within the hollow cylinder, but it disappears gradually, and becomes lost in the flocculent substance of the suspensor. becoming at last so far attenuated as to disappear in the form of separate granular cells. From these facts we may infer that this suspensor is only a portion of the amniotic body which has not been obliterated, or in which albuminous grains have not been deposited—a condition of development clearly indicated by the acute sagacity of the late Mr. Robert Brown*.

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* "In other cases the albumen is formed by the deposition of granulated matter in the cells of the nucleus. In some of these cases, the membrane of the amnios seems to be persistent, forming, even in the ripe seed, a proper coat for the embryo, the original attachment of whose radicle to the apex of this coat may also continue." (Gen. Rem. p. 57.) This view applies as well to the origin of the vitellus in many seeds as to the peculiar development existing in *Ephedra*; and it is probable that future researches may show the existence of an analogous development in other cases, and may lead to a knowledge of the true affinities of the *Gnetaceæ,* which we have yet to learn.

We ought not, therefore, to attach much importance either to the mere circumstance of a suspensor as a proof of the close alliance of the *Gnetaceæ* with the *Coniferæ* and *Cycadaceæ*, seeing that it is always diversified in the several genera, and different from that structure in those families—or to the occasional presence of filaments bearing sterile embryo-sacs, for these never occur in *Ephedra*, and not always in *Gnetum*—or to the existence of disciform dotted vessels in the wood, for they are found only in *Gnetum*. These are only partial coincidences, and consequently of little value in comparison with the strong evidence showing a far more advanced perfection of floral structure in the *Gnetaceæ*, and pointing to a much higher position in the system. Other analogies remain to be discovered before this point can be safely determined. I may here mention that all the details of structure which I have observed will be minutely shown in the drawings of the various analyses intended to illustrate the genus *Ephedra*.

The following is a description of all the South American species of the genus known to me:—

1. *Ephedra Chilensis*, n. sp.;—ramis ramulisque oppositis, validiusculis, pallide viridulis, granuloso-striatellis, internodiis longiusculis vel mediocribus, axillis valde nodosis; foliis rudimentariis, oppositis, crassiusculis, margine tenuibus, imo in vaginam membranaceam serius ruptam connatis, laciniis lineari-acutis; ramis floriferis axillaribus, brevibus vel brevissimis, apice spicellas 1–2–3 sessiles gerentibus; spicellis ovatis vel oblongis, ex involucellis per paria 6, decussatim oppositis et imbricatis; involucellis ovatis, obtusis, per paria imo connatis: floribus ♂ in involucellis solitariis, hinc decussatim oppositis, perigonio incluso; antheris 6, in columna subsessilibus et exsertis: fl. ♀ pedunculo in axillis solitario, elongato, supra medium 2-bracteolato, spicella solitaria terminato, involucellis per paria 5 imo nexis; acheniis 2, terminalibus, inclusis.—Chile, Prov. Valparaiso, *v. v.* in variis locis; *v. s. in herb. Hook. et Mus. Brit.* (Cuming, n. 372; Bridges).

A low shrub, with numerous virgate constantly dividing branchlets, which are opposite in most of the nodes, more rarely 4, verticillate, from 1 to 1¼ line in thickness, the internodes being 1½ to 2 inches apart; the opposite leaflets, 2 to 3 lines long, are at first united for nearly their entire length into a membranaceous vaginant sheath, which afterwards becomes torn, by the swelling of the node, into two acute segments, coriaceous at base. The male inflorescence consists of one to four crowded spikelets upon a very short pedicel, thus forming almost glomerated heads on each side of every node: each spikelet is 3 lines long, 2½ lines broad; the petaloid perigonium in each involucel is turbinately tubular, compressed, delicately membranaceous, of an orange-yellow colour, 1 line long (thus somewhat exceeding the length of its involucel), its border consisting of two rounded concave, erect lobes, which are imbricated in æstivation in the manner before described; the exserted anthers are subglobose, of a bright yellow colour, opening by two pores in the apex. The female peduncle is 10 lines long, bearing spikelets in which the achenia were destroyed by insects*.

2. *Ephedra bracteata*, nob. Trav. ii. 531;—ramis erectis, ramulis ternatim verticillatis aut oppositis, tenuioribus, divaricatis, fusco-viridibus, minutissime granuloso-striatellis, internodiis longiusculis; foliis oppositis, rarius ternis, imo in vaginam submembranaceam connatis, apicibus longissime et anguste linearibus; inflorescentia ♂ et ♀ interdum in eadem planta; spicellis ♂ 2–3 in quaque axilla subsessilibus, imo bracteatis, involucellis 1-floris, per paria 6–8 imo connatis decussatim imbricatis, perigonio involucello paulo longiore, flavido, petaloideo, antheris 6 sessilibus longe exsertis; spicellæ ♀ involucellis imbricatis, majoribus, coriaceis, marginellatis, achenia 2 collateraliter terminalia ultra medium velantibus.—Chile, Prov. Valparaiso et Coquimbo, *v. v.* ad Concon; *v. s. in herb. Hook.*, Viña de la Mar (♂ & ♀ Bridges, No. 178), Viña de la Mar (Anderson, anno 1830), Coquimbo (Harvey ♂).

A shrub growing to the height of 2 to 5 feet, with the habit of the preceding, from which it differs by several marked characters. The branches are more slender, darker, with internodes 1¼ inch apart; the leaflets are opposite, sometimes ternate, 3 to 4 lines long, united at base into a vaginant tube 1 line in length, the segments being somewhat erect and linearly setaceous. The male spikelets are 2½ lines long, 1½ line broad, formed of two sets of basal bracts and six or eight pairs of floriferous decussately imbricated involucels, united into as many vaginant sheaths at their bases; the perigonium of each solitary opposite flower is of a yellow colour, 1 line long, with a two-lobed erect border; the staminal tube is 1½ line long, supporting the subsessile subglobose yellow anthers, which open by two pores in the apex. The fructiferous spikelet is 3 lines long, 2 lines broad, formed of four series of imbricated involucels void of flowers; they are coriaceous, 1½ line long, 1½ line broad, each united with the opposite one into a sheath at its base; the two terminal achenia, more than half invested by the superior involucels, are 2 lines long, 1¼ line broad, flat on the contiguous faces, and convex externally, of a somewhat glauco-fuscous colour, the summit being terminated by an obtuse perforated gland, through which the shortly exserted slender tubillus passes, which has a unilabiate termination. The pedicel supporting the fructiferous spikelet, which in Bridges's specimen is not fully grown, is 4 lines long, with a pair of bracteoles a short distance below: in Anderson's specimen the pedicel is 10 lines long, the bracteoles being at a distance of 2 lines, and the spikelet is double the size of the former. It should be remarked that, in Bridges's plant, a fructiferous spikelet is found on one of the lower branches of the same specimen the upper branches of which all bear male flowers *.

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* A drawing of this species, with analytical details, is given in Plate 75 A.

3. *Ephedra monticola*, n. sp.;—ramis oppositis, substrictis et suberectis, valde ramosis, striatis, brunneis, ramulis junioribus teneribus, imo in vaginam vix nexis; pedunculis axillaribus in flor. ♂ subbrevibus vel brevissimis, spicellam unicam ovatam gerentibus; involucellis in paribus 3–5 decussatim imbricatis, ovatis, obtusis vel mucronulatis, subcoriaceis, margine membranaceo cinctis et floribus totidem includentibus; perigonio petaloideo, vix longiore; columna staminifera 2-plo longiore; antheris 5–7, ovalibus, subsessilibus: spicellis fructiferis solitariis, ovatis, pedunculo ramuliformi 2-bracteolato suffultis; acheniis 2, in involucellis supremis absconditis.—Chile, Cordillera de los Andes, utroque latere; *v. s. in herb. Hook.* (♂ et ♀ Bridges, No. 1210).

A shrub, from its very elevated locality, probably of low growth, with more erect and more slender branches than the preceding species, from which it differs in its general appearance, in its much smaller bractiform leaflets, and in its achenia being hidden by the last pair of involucels. Its branchlets are opposite, but sometimes two superimposed grow out of each axil: these are floriferous, nearly ½ line in diam., with internodes 9 to 11 lines apart. The peduncles are axillary, 1 to 2 lines long, with a pair of bracteoles supporting them at their origin; and they bear a solitary male spikelet, which is ovate, 2½ to 3 lines long, bracteated at base, with four pairs of imbricated involucels briefly conjoined at their base into a sheath, subcoriaceous and 1 line long; perigonium somewhat longer than its own involucel; staminiferous column twice its length, bearing 5–7 sessile yellow anthers opening by two pores in their apex. The fructiferous spikelets are on a distinct specimen: here the peduncle is 1 inch long, 2-bracteolate a little above the middle, bearing a solitary oval spikelet 3 lines long, 2 lines broad; involucels broadly ovate, gradually diminishing towards their summits, coriaceous, with a narrow membranaceous border; two erect achenia 1½ line long, elliptic, plano-convex, perforated at the apex, with no portion of the tubillus exserted*.

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* This species is figured in Plate 75 B.

4. *Ephedra Andina,* Pöpp.; Meyer, Mem. Acad. Petrop. v. 78; —caulibus plurimis subhumifusis, ramis ramulisque ramosissimis adscendentibus, singulis ad pedem vaginatim foliosis, flexuosis, nodosis, subarticulatis, internodiis subbrevibus, viridiusculis, granuloso-striatellis; foliis minimis, oppositis, coriaceis, acutis, imo vaginatim nexis, lobis in junioribus subulato-acuminatis, mucronulatis, serius distinctis; spicellis ♂ axillaribus, breviter pedunculatis, solitariis vel binis glomeratis, basi 2-bracteolatis; involucellis per paria 6 decussatim oppositis et imbricatis, imo vaginatis, obovatis, primum submembranaceis et flavescentibus, serius subcoriaceis et membranaceo-marginatis; perigonio petaloideo, limbo 2-lobo; columna staminifera longe exserta, antheras 5–6 sessiles apice 2-porosas gerente: spicellis fructiferis axillaribus, solitariis, longe pedunculatis; pedunculo in medio 2-bracteolato; involucellis majoribus, magis coriaceis; acheniis 2, collateralibus, terminalibus, glaucis, striatellis, involucello paulo longioribus, apice perforatis; tubillo breviter exserto, apice inæqualiter fisso aut lacerato.—In Andibus Chilensibus; *v. s. in herb. meo et Hooker.,* ♂ Cordillera de Maule (Germain); *in herb. Hooker.,* ♀ Chile australis (Dr. Philippi).

In the memoir above cited, Meyer has confounded together (but with some doubt) all the Chilean species of *Ephedra.* The above-described plant, from the provinces south of the River Maule, the region visited by Pöppig, has been selected as the type of *E. Andina,* Pöpp. It is a well-marked species. The foregoing diagnosis, drawn wholly from it, should be substituted for the more general character assigned by Meyer. It seems to be a very bushy plant, its lower branches hanging on the ground, and its ramifications rising upwards. In Germain's specimens, a cross section of its branches exhibits three or four distinct annular zones, showing a solid white wood with close medullary rays: these are 2½ lines in diameter, and very flexuose; its bark is thick and of a brownish colour, but in the younger branchlets of the last year's growth it is of a yellowish green, the internodes being 1½ to 2 inches apart. The axillary branchlets or peduncles which bear the ♂ flowering spikelets are generally half a line, seldom 2 lines, in length; these spikelets are 2–2½ lines long, with six pairs of imbricated involucels; the perigonium is ¾ line long, and the staminal column, rising above it, becomes 1½ line in length. The fructiferous spikelets, upon a distinct plant, supported by a peduncle 2 to 4 lines long, are 3 to 3½ lines in length, and are formed of three pairs of imbricated involucels, with a pair of bracts upon the peduncle. The two terminal achenia, embraced by the last pair of involucels, which are somewhat shorter than them, and subscarious, are plano-convex, oblong, pointed towards the small perforated apex, where they are marked by a small yellowish glandular ring which I have considered to be the persistent sessile stigma; the exserted portion of the tubillus is barely a line long, and is irregularly lacerated and scarcely 2-lobed*.

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* A figure of this plant will be seen in Plate 76 A.

5. *Ephedra dumosa*, n. sp.;—ramis arcuato-flexuosis, valde ramosis et intricatis, internodiis subbrevibus aut mediocriter distantibus; ramulis divaricatis, striatellis, granuloso-scabridulis, rufescentibus vel fuscis; foliis oppositis, coriaceis, granuloso-striatulis, fusco-rubescentibus, imo in vaginam amplam brevem connexis, vix marginatis, apicibus breviter mucronato-acutis, vagina demum rupta linearibus: spicellis fructiferis solitariis, brevissime pedicellatis; involucellis per paria imo nexis, imbricatis, ovatis, subcarnosis, rubescentibus, achenia omnino amplectentibus; acheniis nigris, nitidis, tubillo breviter exserto, obsolete 2-lobo.—In Andibus Chilensibus, *v. v.* ad Cortaderas costa orientali; *v. s. in herb. meo et Hook.*, Cuesta del Inca (Gillies).

A low bushy shrub, which I found growing near the Ladera de las Cortaderas, on the eastern side of the Andes, and of which I still preserve the ripe fruits, though my specimen was lost. Dr. Gillies's plant, from the eastern side of the Portillo Pass, is more dwarfish, and is without flower or fruit. The branchlets are opposite, the internodes being only 6 to 12 lines apart; the vaginant portion of the combined opposite leaflets is ½ line long and subcampanulate, the segments being of equal length, and triangular. The fructiferous spikelets are solitary, 3 lines long, 2 lines in diameter; the involucels, broad and very fleshy, of a dull dark ruddy hue, quite conceal the two terminal achenia: the latter are ovate, diminishing upwards, plano-convex, shining, unevenly striated, each obtuse at its acumination, where it is perforated and surrounded by an apical annular gland; the tubillus, rising through this, is very little exserted, and very briefly bifid, or rather lacerated into two very short, erect, concave, rounded, unequal lobes†.

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* A representation of this species, with ample details, is given in Plate 76 B.

† This plant, with analyses of its carpological structure, is shown in Pl. 77 A.

6. *Ephedra ochreata*, n. sp.;—suffruticosa, ramis virgatis ramulisque validis adscendentibus, sæpissime fusco-viridibus, striatellis, granuloso-scabridulis, epidermide facile rimosa, internodiis remotiusculis; foliis 3-nis vel 4-nis, rigido-submembranaceis, in vaginam longiusculam striatellam connexis, apicibus subulatis, serius omnino disruptis, tunc liberis et reflexis: spicellis ♂ oppositis, 3-nis vel 4-nis, in axillis sessilibus et subglomeratis, oblongis, ad basin imbricato-bracteatis; involucellis in seriebus ternatis 6–9, imo nexis et decussatim alternantibus, ovatis, subcoriaceis, margine vix membranaceis, perigonio subæquilongis; antheris 5–6, exsertis: spicellis fructiferis 2–4, breviter pedicellatis, subverticillatis; acheniis 2, oblongis, subacutis, ultra medium exsertis.—In Provinciis Argentinis, Travesia de Mendosa ♀ mihi lecta; *v. s. in herb. Hook. et Mus. Brit.*, ♂ Patagones, Prov. Buenos Ayres (Tweedie), Bahia Blanca (Darwin), Port S. Elena (Capt. King), Bahia San Antonio. Var. *striata* ♂ et ♀ Mendosa (Gillies).

A very distinct species, with long virgated and somewhat curving branches, which are striated, 1 to 2 lin. diam., the internodes being 2 inches apart; the younger ones are somewhat fistulose, with a central pith, but the older branchlets are entirely woody; four branchlets issue from a node, two being superposed in each opposite axil; or there are three verticillate branchlets at a joint; the leaves are 4 lines long, seldom opposite, most frequently ternate, and united together as far as their middle into a sheath which loosely embraces the stem; they are membranaceous, with a subulately acuminate apex terminating in a long cuspidate point proceeding from the excurrent nerve; four sessile male spikelets are placed verticillately round each node within the ruptured sheath, the leaves now becoming reflexed and withered; these spikelets are 2 lin. long, and 1½ lin. broad; each consists of three series of imbricated bracts at base, and nine other floriferous series closely imbricate and alternately decussate, each series consisting of three involucels vaginately united at base; the flowers, from twenty-five to thirty in each spikelet, are therefore ternately verticillate in each series. The perigonium is petaloid, of the usual form, of delicate reticulated texture, the areoles being generally disposed in longitudinal rows sometimes anastomosing with each other, each areole being isolated and replete with a coloured fluid; there is no vestige of any nervure or spicular cells as in *Welwitschia*. The involucels are similarly reticulated, but they finally become thickened, opake, and coriaceous, except round the margins; the coriaceous portion is constituted in the manner described in a preceding page (p. 162). The fructiferous spikelets, upon distinct but similar plants, are two to four in each node, 4 to 4½ lines long, 2 lines broad, verticillately disposed, each upon a separate pedicel; their involucels, in about five gradually decreasing imbricated pairs, are smooth, opake, subcoriaceous, with almost obsoletely membranaceous margins. The two terminal achenia, half invested by the last pair of involucels, are ovate, somewhat attenuating upwards, trigonous, with an obtuse pallid perforated summit, the tubillus, with lacerated apex, being scarcely exserted*.

The variety *striata* of Gillies possesses all the specific features; but the branchlets are less than half the thickness, they are glandularly scabrid, of a pallid colour; the internodes in the male plant scarcely exceed an inch, while those of the fructiferous plants are 1 to 1½ inch apart; the leaves, 2½–3 lines long, are united for above half their length into a 3-fid vaginant tube. There are about six smaller glomerated heads around each node. The fructiferous spikelets are 3 lines long, 2 lines broad, with three pairs of subcoriaceous involucels with scarious margins, the terminal pair enclosing two finely striated, opake, fuscous achenia. It may probably form a distinct species; but there is little that can be characterized.

7. *Ephedra Americana*, H. B. K. ii. 2; Rich. Conif. 31. tab. 29; Meyer, Mem. Acad. Petrop. v. 100;—ramulis graciliusculis, erectis, subflexuosis, striatellis, pallide virentibus, vix scabrellis; foliis oppositis, imo ad nodos in vaginam brevem nexis, lobis liberis longiusculis, linearibus, subulato-acuminatis, erecto-patulis, submembranaceis, glaberrimis, crebre striatellis, serius ruptis et divaricatis, linea transversali tunc nexis: spicellis ♂ axillaribus, sessilibus, subglobosis, oppositis vel 4-verticillatis; involucellis per paria 8–10, floriferis, imbricatis, valde concavis; perigonio paulo longiore, petaloideo; columna staminali 7-nervi; antheris 5–7, exsertis: spicellis fructiferis in quaque axilla solitariis vel binis, breviter pedicellatis; involucellis majoribus, glauco-opacis, marginibus anguste membranaceis; acheniis 2, terminalibus, subinclusis, apice calloso perforatis.—In Peruvia; *v. s. in herb. Mus. Brit.*, ♂ et ♀; *in herb. Hook.*, ♀ Chachapoyas (Mathews, 1838).

Kunth describes this as a somewhat erect or repent shrub, very much branched; the branchlets are slender, scarcely ½ line diam., with internodes 1 to 1⅛ inch apart. The leaves are 3 to 5 lines long, 1 line broad, setaceously acute, of a reddish colour, and ultimately subreflexed. According to that botanist, the male and female flowers are found on the same plant, in the proportion of three of the former to one of the latter; but in the instances I have seen, the sexes are on different specimens. The male spikelets are solitary and sessile in each opposite axil; they are 2 lines long, 1½ line broad, with six or eight series of floriferous opposite involucels conjoined at base in alternating pairs, and three series of basal bracts; the involucels are suborbicular, with a fleshy very concave centre and a simply reticulated margin, the central portion being formed of three separable laminæ, as described in page 162. The perigonium is petaloid, simply reticulated, with spotted areolæ, but without vessels of any kind. The fructiferous spikelets are elliptic, 3 lines long, 2 lines broad, supported on pedicels 1 line long. The mesocarp of the pericarp is filled with numerous very long, and apparently solid, filiform woody fibres imbedded in fleshy matter. In a half-ripe state, the tubillus is distinctly seen to be continuous with the outer integument of the seed, a considerable space intervening between it and the gland, and between it and a long portion of the summit of the seed*.

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* Ample details of structure, and a figure of the plant, are given in Plate 77 B.

8. *Ephedra rupestris,* Bth. Plant. Hartw. p. 253;—humilis, intricato-ramosissima; ramulis rectiusculis vel arcuatis, fusco-opacis, valde striatis, granuloso-scabrellis, ad axillas paulo nodosis; foliis oppositis, imo in vaginam brevem nexis, superne in lobos triangulares extus subcarinatos mucronatos terminatis, minute granulosis, coriaceis, hæmaticis: spicellis ♂ axillaribus, solitariis vel binis, sessilibus; involucellis oppositis, imo nexis, 3–4-serialibus, imbricatis, carnosulis, fuscis, perigonio brevioribus; antheris circiter 5, sessilibus, longe exsertis: spicellis fructiferis in axillis solitariis, breviter pedicellatis; involucellis per paria 4–5, imbricatis, fuscis, carnosulis, minute granulosis; acheniis 2, terminalibus, inclusis; tubillo exserto, subtruncato, rubello.—Ecuador; *v. s. in herb. Hooker.*, ♂ Monte Pelzhum, altit. 12,000 ped. (Jameson), Monte Cotopaxi, altit. 12,000 ped. (Jameson), Monte Antisana ♀ (Hartwegg, No. 1394).

Apparently a shrub of stunted growth, found in the fissures of rocks at a great elevation, the branchlets being ½ to ¾ line thick, with internodes 5 to 7 lines apart; opposite leaflets 1 line long, which for half their length are united into a vaginant tube round each node, becoming afterwards more or less torn to their base. The male spikelets are 2 lines long, 1 line broad, with involucels and perigonium ½ line long; staminiferous column yellow, ¾ line long, bearing five clustered sessile anthers opening by two pores in the apex. The fructiferous spikelets are 2¼ lines long, 1¾ line diam.; the involucels are of a dark brassy metallic hue, with a finely granulated surface.

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* This plant, with full structural details, is shown in Plate 78 A.

The *Ephedra humilis*, Weddell (Ann. Sc. Nat. sér. 3. xiii. 251), from Puno in Bolivia, does not appear to be specifically distinct from the above plant. The species is much allied to the *Ephedra dumosa* described in a preceding page.

9. *Ephedra Tweediana*, Fisch., Meyer, Mem. Acad. Petrop. v. 99. tab. 9;—ramis ramulisque oppositis, ramosis, erectiusculis, teneribus, subvirgatis, pallidis, striatis, subgranulosis, imo vaginatis, ad axillas nodosas subarticulatis, internodiis subelongatis; foliis oppositis, aut rarius verticillatim ternis, distinctis, imo linea transversali nexis, basi concavis, superne hyalino-membranaceis, acuminatis, et in setam longissimam filiformem terminatis: spicellis ♂ in quaque axilla solitariis, vel 2–3–4 glomeratis, sessilibus, oblongis, acutis, basi 4-bracteatis; involucellis per paria 4–5, imo nexis, decussatim imbricatis, ovalibus, crassiusculis, margine membranaceis, perigonio subæquilongis; antheris sæpius 3, interdum 4–5, sessilibus, oblongis, vix exsertis: spicellis fructiferis similibus, sed 2-plo majoribus, brevissime pedicellatis; involucellis majoribus et paulo crassioribus, pallidis, coriaceis, anguste marginatis; acheniis 2, navicularibus, pallide opacis, oblongis, gradatim angustioribus, apice obtuso perforatis, tubillo exserto, irregulariter lacerato.—In Provinciis Argentinis, *v. v.* Coro Corto (Prov. Mendosa) et Travesia de Mendosa, ♂ et ♀ (mihi lecta, anno 1826); *v. s. in herb. Hooker.*, Travesia de Mendosa (sub *E. Mendocensis*) et in Pampas (sub titulo *E. australis*) (Gillies); Patagones (Carmen, Rio Negro) in Prov. Buenos Ayres, ♂ et ♀ (Tweedie).

This species appears to have a wide range over the extent of the Pampas, in localities which are more or less saline. It has a branching ligneous root, from which numerous slender stemlets ascend, which throw off other occasional branchlets at the nodes, forming a shrub 1 or 2 feet in height, with somewhat longer branches which run along the ground or trail upon others for support. The opposite or verticillately disposed branches are slender, subflexuose, of a pale greenish colour, ¾ to 1 line diameter, with internodes 1 to 1¾ inch apart; the nodes are somewhat swollen, often articulate, and embraced by the bases of the leaves, which form opposite cup-shaped cartilaginous projections at each node, joined together by a transverse line; the leaflets are 3 lines long, subulate, suberect, with hyaline membranaceous margins, gradually diminishing into a long curved setaceous point. The male spikelets generally abound in the younger branchlets, where two or three are often crowded together in each axil; these are oblong, somewhat tapered, formed of about five pairs of decussately opposite involucels, each pair united at base into a short vaginant tube; the involucels are ovoid, slightly acute or obtuse, glaucescent, subfleshy, with a narrow membranaceous margin, each enclosing a petaloid perigonium of about their own length, which is campanulately tubular, compressed, and expanded into two broad rounded erect lobes, as long as the tube, imbricated in æstivation; the staminiferous column, scarcely exceeding the length of the perigonium, bears on its apex three to five crowded, erect, sessile anthers, which are 2-celled and open by two pores in the apex. In the specimen from Patagones, the number of anthers is constantly three, which number occurs in the other localities, but only occasionally. The fructiferous spikelets are on different specimens, and vary only from those of the male flowers in being generally solitary upon a very short pedicel in each axil, and are about double their size, being 3 lines long, 2 lines broad, gradually narrowing upwards, with about six pairs of involucels, the three upper pairs being the largest, and all barren except the last pair, which embraces $\frac{3}{4}$ of the length of the two terminal achenia; these involucels are greenish, and ultimately brown, 2 lines long, 1½ line broad, and pointed: the achenia are fuscous brown, opake, broadest at base, gradually attenuated upwards, flat inside, with a somewhat sharp margin, rounded and carinated on the opposite face, their section being somewhat trigonous, 3 lines long, 1½ line broad, the small obtuse apex being glandular and perforated; the tubillus is exserted, and irregularly lacerated, not disciform as Meyer has stated, although he figures it as I have described it*.

10. *Ephedra scandens*, n. sp.;—scandens, vage ramosa; ramis strictis, ramulis junioribus floriferis sæpe 4–12 verticillatis ex quoque nodo, gracilibus, subflexuosis, pallidis, striatellis, fere lævibus, internodiis longiusculis, ad nodos subarticulatis; foliis in axillis oppositis, imo inter se nexis et vaginatis, lobis brevibus, obtusis, membranaceis, serius disruptis et liberis: spicellis ♂ in quaque axilla 1–2–3 glomerulatis, sphæricis, capitulum globosum simulantibus; involucellis rotundatis, concavis, fusco-rubentibus, subcarnosulis; ramulis floriferis demum elongatis: spicellis fructiferis 1 ad 3 ex quaque axilla, longe pedicellatis; acheniis semiinclusis.—In Provincia Uruguay; *v. s. in herb. Hook.*, Banda Oriental (Tweedie, Baird), Parana et Entre Rios (Gibert, Nos. 9 et 75).

Tweedie describes this species as climbing to the tops of the loftiest trees of the forest; and Baird says it is used by the natives for dyeing a fine scarlet colour. The branchlets are slender, of a pallid green, not more than ½ to ¾ line diameter, with internodes 1½ to 2 inches apart. The leaves are very small and membranaceous, not exceeding 1 line in length. The male spikelets, generally about six, are crowded together in a capitate form around each node ; the spikelets are subglobose, 1 to 1½ line diam., composed of about five pairs of closely imbricated involucels, which are rounded above, and concave, somewhat fleshy, of a dark ruddy colour, and opake; the perigonium, of the same size, is of a reddish hue, beyond which six to eight bright yellow sessile anthers are exserted. The fructiferous spikelets, on distinct specimens, are usually solitary in each axil; each spikelet is supported on a very slender pedicel, 2 to 3 lines in length, which is deflected; it is acutely elliptic, 3 lines long, including the two terminal achenia, which are half-enclosed within the last pair of involucels; the involucels are in three imbricating pairs, with two pairs of bracts at base; they are oblong, rather obtuse, of a greenish-brown colour, becoming somewhat reddish, with a very narrow white margin : the achenia are acuminately oblong, trigonous, 3 lines long, 1½ line broad, granularly striated, of a dark ruddy brown, with a somewhat 3-lobed white gland in the apex, which is perforated for the passage of the tubillus, this being scarcely exserted and lacerated at its apex*.

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* A representation of this species, with structural details, will be seen in Plate 78 B.

11. *Ephedra frustillata*, n. sp.;—nana, ramosissima; ramis ramulisque iterum ramosis, brevissimis, oppositis, vel sæpe 4-natim verticillatis, sulcatis, granuloso-asperatis, rufo-aurantiacis, singulis imo vaginatis; foliis axillaribus, oppositis, parvis, ovatis, concavis, rubescentibus, crassiusculis, margine vix marginatis, primum usque ad medium in vaginam 2-dentatam connexis, serius disruptis: spicellis ♂ in apice ramulorum ultimorum solitariis, sessilibus, subovatis; involucellis per paria 4–6, decussatim oppositis, et basi nexis, crebre imbricatis; perigonio 2-labiato, involucello 2-plo longiore, labiis adpressis, rotundatis ; antheris 5, globosis, in columnam exsertam crebriter sessilibus.—Patagonia ; *v. s. in herb. Hook. et Mus. Brit.*, Port Desire (Darwin).

A stunted shrub, apparently not more than 4 inches in height, with a repent caudex, out of which the somewhat ascendent branches originate, which immediately divide themselves at every half-inch distance into verticillated ramifications round each axil, the ultimate ones being floriferous, with a pair of short vaginant bractiform leaflets round each node, and a similar stipuloid sheath round the base of each ramification. They are all of a dull reddish orange-colour. The male spikelets are ovate, 2 lines long*.

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* This species is shown in Plate 79 A.

On the Tricuspidarieæ, a Subtribe of the Elæocarpeæ.

The *Elæocarpeæ*, as a natural order distinct from *Tiliaceæ*, was proposed in 1808 by Jussieu, who united with it the *Tricuspidaria* and *Vallea* of the 'Flora Peruviana.' Kunth, in 1821, followed this example; but, in a note, he suggested that it might well form a distinct tribe of the *Tiliaceæ*. De Candolle, in 1821, adopted the view of Jussieu, adding to the list *Friesia* and others now subgenera of *Elæocarpus*. Lindley, in 1836, in his 'Nat. Syst.,' followed a similar course; but in 1845, in his 'Veget. Kingd.,' he adopted the hint suggested by Kunth, uniting the family with *Tiliaceæ* as a distinct tribe. The authors of the new 'Genera Plantarum,' in 1862, followed this arrangement under some modifications, excluding *Vallea* upon very insufficient data, and amalgamating *Friesia* with *Aristotelia* and *Crinodendron* with *Tricuspidaria* upon slender grounds. After a careful examination of these several genera, I am led to follow the views of Endlicher in maintaining the *Tricuspidariæ* as a subtribe distinct from *Elæocarpeæ*, which are distinguished from one another by very salient and constant characters. In the former the petals, though three-lobed at the apex or nearly entire, are never fringed as in the *Elæocarpeæ*; in the latter the fruit is a drupe, with a single thick osseous endocarp, assuming the shape of an indehiscent tuberculated nut, which, by abortion, is seldom more than 1- or 2-celled, each cell producing a single seed (not suspended from the summit, as generally stated, but) appended by the middle of its ventral face. On the other hand, the *Tricuspidariæ*, besides the difference in the form of the petals, have a fruit always 3–5-celled, with two or more superposed seeds in each cell, and either capsular and dehiscent or else baccate with a membranous endocarp. But a still more forcible distinction exists in the nature of the integuments of the seeds. In the *Elæocarpeæ* the outer integument is chartaceous, thin, and brittle, the second tunic being submembranaceous; but there is no osseous coat. In the *Tricuspidarieæ* the seeds invariably have three tunics: the outer one is thick and fleshy, in which the chord of the raphe is imbedded; the second coat is thick, osseous, obpyriform, truncated at its base, where, beneath the chalaza, there is always a distinct chamber, into which the vessels of the raphe find their way; the third tunic is opaque, somewhat membranaceous, with a large orbicular chalaza at its base, corresponding with the chalazal base of the bony tunic. No structure of this kind is seen in the *Elæocarpeæ*; but it is constant in all the *Tricuspidarieæ*. An analogous organization is observable in the *Sloaneæ*, the seeds of which have a similar red-coloured fleshy covering, which has been designated by some authors an arillus; the second tunic is osseous, and broadly truncated at its base by a large orbicular chalaza; but this wants the hollow chamber below it, which forms a characteristic feature in the *Tricuspidarieæ*.

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* A representation of this plant is given in Plate 79 B.

In regard to the nature of these seminal envelopes, the outer coat may be regarded as an *arilline*, analogous to a similar tunic which I formerly described covering the osseous coat in the seeds of *Clusia* and *Magnolia**. Upon the nature and origin of these integuments I then endeavoured to offer an explanation, which was contested by others, who maintained that in these cases the outer fleshy covering is merely the epidermis of the bony coat, both being elicited by the growth of one single tunic, the primine of the ovule. There is a bar to such an argument, in the instance of *Aristotelia*, in the existence of the singular appendage upon the outer fleshy coat, resulting from the duplicature of that integument, which could not occur if it were merely an epidermis. By those who have not studied the subject, the origin of this appendage might be attributed to a fungous enlargement of the funicle (as Gaertner supposed in an analogous instance†) or to an expansion of the chalaza; but a more careful examination will show that it is too remote from the latter and from the hilum to admit of such a supposition. Whatever be its origin, this outer tunic appears to be an integument wholly independent of the bony shell, consisting of its reticulated epiderm, a fleshy mesoderm replete with resinous cells, and an endoderm in the form of a white, opaque, reticulated cuticle, separable from the shell, the chord of the raphe being found within its substance.

The fact that this fleshy tunic and bony shell are two distinct integuments is shown by an examination of the unimpregnated ovules in the abortive cells of *Aristotelia*: here, with the ovules grown to the length of half a line, I have succeeded, by means of a longitudinal section, in actually separating them. The tunics, which, if fertilized, would have grown into the fleshy coating and bony shell, are then seen as two distinct, thin, membranaceous integuments, easily separable at this stage, the second being a little shorter and more pointed than the first or outer one, the third integument, enclosing the rudimentary nucleus, being still shorter than the others. It is worthy of notice that at this stage the outer integument exhibits the peculiar appendage or duplicature so conspicuous in the ripe seed.

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* Linn. Trans. xxii. 89, tab. 19. figs. 56–59; Contrib. Bot. i. 219; Ann. Nat. Hist. ser. 3. i. p. 276.

† De Fruct. ii. 271.

The *Tricuspidarieæ* may be divided into two sections: the first, having a baccate fruit, mostly indehiscent, comprises the genera *Aristotelia*, *Friesia*, and *Vallea*; the second, with a capsular fruit, consists of *Tricuspidaria* and *Crinodendron*,—in all, five genera. Having studied their structure with much care, I proceed to describe each genus separately.

1. Aristotelia.

This genus, established by L'Héritier upon the well known Maqui of Chile, was referred by the late Mr. Brown and De Candolle to the *Homalineæ*; by Endlicher it was made into a suborder attached to *Ternstrœmiaceæ*; Von Martius also made it a suborder (*Maquinæ*), which he placed near *Pittosporeæ*; Lindley considered this suborder allied to *Philadelphiaceæ*; Reichenbach placed it in *Escallonieæ*; but Don was the first who rightly indicated its affinity with the *Elæocarpeæ*, to which alliance it unquestionably belongs. The genus for many years was confined to its single typical species; but Dr. Hooker, in his 'Flora Zelandica,' associated with it the genus *Friesia*. There are so many points of structure in the Chilean plant at variance with the several species of *Friesia*, that it appears to me this genus cannot remain amalgamated with *Aristotelia*, for the following reasons.

In *Aristotelia* the petiole is always 2-glandular at its apex; and the teeth of the leaves have each a glandular termination. In *Friesia* no indication of any gland is seen either on the leaves or petioles.

In *Aristotelia* the flowers are usually 5-merous, with a 3-celled ovary, and always hermaphrodite or else polygamous, with only a partial depauperation of the male or female organs. In *Friesia* the flowers are 4-merous, with a 4-celled ovary; and they are described as being diœcious in most instances.

In *Aristotelia* the petals are not divided at the apex, being only slightly emarginated or truncated; and the absence of this feature led botanists to believe, for a long time, that it could not belong to *Elæocarpeæ*; they are white, with a slightly yellowish tinge. In *Friesia*, on the other hand, they are more or less deeply 3-lobed at the apex, as in other *Tricuspidarieæ*, and are generally marked with a deep purple colour.

In *Aristotelia* there is a large, deep, cup-shaped disk fixed on the thickened apex of the pedicel or torus, to which the sepals are agglutinated by a broad line of attachment. In *Friesia* there is no circular disk; but in lieu of this we see four small free fleshy glands emanating from the narrow torus and placed opposite to the sepals.

In *Aristotelia* the stamens are inserted upon the pentagonal cup-shaped disk, in the bottom of which the ovary is placed; the fifteen stamens are in five phalanges, three being fixed biserially upon each angle of the disk, two of them more internally than the other, the filaments rising out of as many prominent foveated articulations; and in this manner all the stamens are opposite to the sepals and none face the petals. In *Friesia* the twelve stamens are arranged in a single whorl opposite to the sepals and petals alike, and they are fixed around the ovary within and independent of the fleshy glands. The difference is, therefore, that in one case the stamens are borne *upon* the disk, and in the other are situated *within* the disk.

In *Aristotelia* the fruit is extremely baccate, the mesoderm being copious, fleshy, and capable of fermentation; so that the berries are used by the natives of Chile in the fabrication of a kind of wine, of which they are very fond. In *Friesia* the fruit, though indehiscent and of similar form, has a dry testaceous pericarp. It is three-celled in the former, 4-locular in the latter.

In *Aristotelia* the outer fleshy integument of the seed is furnished, below the hilum and above the chalaza, remote from both, with an enlargement in the form of a horny laminar prolongation, decurrent for some distance, and then arched over involutely; it appears like a sacciform duplicature of the integument, filled with long corneous cells. Where only one seed is perfected, this process is either superior or inferior, according as the upper or lower ovule is fertilized; when two seeds are matured, which are always superposed, the process is seen upon one seed on the right hand of the line which separates them, and upon the left in the other. This appendage is not unlike that figured by Gaertner in *Ganitrus* (*Elæocarpus serratus*), ii. p. 271, tab. 140, and is often seen in the seeds of *Elæocarpus* and *Monocera*: it has not before been noticed in *Aristotelia* by any botanist, except Prof. Agardh, who, in his 'Theor. Syst.' p. 276, alludes to it as appearing upon the "putamen." In *Friesia* the corresponding fleshy tunic is quite smooth, without any such appendage.

In *Aristotelia* the second or osseous tunic is externally quite smooth; in *Friesia* it is always very tuberculated.

It appears to me, therefore, that with so many and such prominent differences of structure, it must be conceded that

Friesia has little to justify its amalgamation with *Aristotelia.* It offers a much closer approximation to *Vallea.*

Gay states that in *Aristotelia* the typical plant has velvety stipules, which are very caducous. I have never perceived any indications of them; and they do not appear in the drawing I made of the living plant forty-five years since. The source of this mistake appears to me obvious; for in the axils of the leaves there is seen an oval bud consisting of several decussately imbricated, velvety, bract-like, concave, pointed, oval scales, out of which a new floriferous branch springs; and these soon fall away after the development of the branch, which is consequently marked at its base by several annular cicatrices, as may be seen in all the dried specimens.

ARISTOTELIA, L'Hér.—*Flores* sæpius hermaphroditi, vel imperfecte polygami, rarius 4-meri. *Sepala* 5, oblonga, acuta, basi toro cupuliformi agglutinata, æstivatione valvata, demum decidua. *Petala* 5, cuneato-oblonga, apice subtruncata et leviter emarginata, sepalis paulo longiora, membranacea, æstivatione imbricata. *Discus* amplus, annulari-cupuliformis, sub-5-gonus, carnosulus, toro arcte adnatus. *Stamina* 15, in phalanges 5 disposita, in foveolis totidem elevatis supra marginem disci inserta, nempe 3 in quoque angulo biseriata, quorum 2 exteriora, omnia sepalis hoc modo absolute opposita; *filamenta* brevia, subulata, compressa, pilosa; *antheræ* lineares, 4-sulcatæ, 2-loculares, loculis collateraliter adnatis, imo breviter divaricatis, in sinu dorsaliter affixæ, erectæ, scabridulæ, apice rima brevi oblique transversa utrinque dehiscentes. *Ovarium* subglobosum, 3-sulcatum, fundo disci insitum, 3-loculare; *ovula* in quoque loculo 2, ad medium axis centralis appensa. *Stylus* erectus, teres, petalis æquilongus; *stigmata* 3, brevia, subulata, subdivaricata. *Fructus* baccatus, globosus, pisi magnitudine, pulpa copiosa gelatinosa tunicatus, 3-locularis, endocarpio dissepimentisque membranaceis, columna centrali tenui ad medium seminifera. *Semina* in quoque loculo 2 vel 1, dorso convexa, ventre angulata, et hinc ad medium *hilo* parvo signata; *integumentum externum* (arillina) nigrum, nitidum, carnosum, processu supra angulum basalem decurrente laminari galeatim inclinato subcorneo appendiculatum, intus *raphe* chordiformi brevi ad basin ab hilo descendente munitum; *integumentum secundum* osseum, ovatum, imo truncatum, hinc crassissimum et foramine in locellum vacuum pro raphes intrusione perforatum, apice mamilla parva (*micropyle*) notatum; *integumentum inter-*

num tenuiter membranaceum, ad basin liberum, hinc *chalaza* magna orbiculari fusca signatum, apice micropyle fusco punctata; *albumen* ovatum, imo valde truncatum, copiosum, carnosum; *embryo* inclusus, paulo brevior, *cotyledonibus* ovatis, crasso-foliaceis, *radicula* tereti ad micropylen spectante 2-plo longioribus.

Arbores *Chilenses sempervirentes;* folia *subopposita, oblonga, glanduloso-serrata, petiolata;* racemi *axillares, brevissimi, pauciflori.*

1. *Aristotelia Maqui*, L'Hérit. Stirp. 31, tab. 16; Lam. Illust. t. 399; DC. Prodr. ii. 56; Gay, Chile, i. 336;—Aristotelia glandulosa, *R. & P. Syst. Fl. Per.* p. 126; *Poir. Suppl.* iii. p. 587;—frondosa, ramosissima; foliis suboppositis, late ovatis vel oblongis, imo rotundatis vel subcordatis, apice subobtusis aut breviter attenuatis, marginibus subrevolutis, dentato-serratis, dentibus glanduliferis, utrinque glabris, nisi in costa nervisque pilosulis, supra læte viridibus, nitentibus, reticulato-venosis, subtus pallidis vel glaucis; petiolo tenui, apice 2-glanduloso, supra canaliculato, limbo dimidio vel 3-plo breviore, puberulo: racemis in ramis novellis axillaribus, ramose 3–5-floris, subpuberulis.—In Chile frequentissima: *v. v. et s.*

An evergreen tree, growing to the height of 12 feet. The leaves are 2½–3 inches long, 1½–2 inches broad, on a petiole 1 inch long; one or two peduncles grow out of each axil, 4 lines long, each bearing on its apex three one-flowered pedicels, 3 lines long, between two minute bracts; the sepals are 1 line long, the petals 1½ line*.

I collected also, in the province of Aconcagua, the variety *Andina*, described by Philippi (Linn. xxxiii. p. 31), and distinguished by its much thicker leaves.

2. *Aristotelia glabra*, n. sp.;—foliis oppositis, oblongis vel lanceolato-oblongis, imo acutis, apice obtusis, membranaceis, marginibus subrevolutis, integris vel obsolete glanduloso-serratis, undique glaberrimis, reticulato-venosis, subconcoloribus; petiolo tenuissimo, glabro, supra canaliculato, apice minutissime 2-glanduloso, limbo 3–4-plo breviore: racemis in ramulis novellis axillaribus, glaberrimis, rachi tenuissima, petiolo paulo longioribus, 3–4-floris.—In Chile: *v. v. et s.* (Prov. Quillota); *v. s. in herb. Mus. Brit.* (*Hort. Kew. cult.* A.D. 1779).

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* A drawing of this plant, with copious analytical details, is given in Plate 80.

This is very distinct from the preceding, in its very glabrous leaves, sometimes acutely narrowed at the base, upon more slender petioles; they are 2–2¾ inches long, ¾–1½ inch broad, upon a petiole 6–9 lines long; the peduncle of the raceme is 6 lines long, its pedicels 2–3 lines long, sometimes abortively with only one or two flowers.

2. Friesia.

This genus has certainly some points of resemblance to *Aristotelia*; but the many differential characters, already enumerated, are too numerous to admit of the two genera being amalgamated together. *Aristotelia* is confined to Chile, while *Friesia* hitherto has been found only in insular positions, being distributed over New Zealand, Tasmania, and Hong Kong. Its generic features may be thus stated:—

Friesia, DC.;—Aristotelia (*in parte*), *Hook. fil.*—*Flores* dioici aut polygami. *Sepala* 4, oblonga, utrinque subobtusa, æstivatione valvata, decidua. *Petala* 4, cuneato-oblonga, apice 3-loba, lobis oblongis, rotundatis, sepalis paulo longiora, æstivatione imbricata. *Discus* e glandulis 4 squamiformibus carnosulis sepalis oppositis tori margine enatis constans, pilosus. *Stamina* 12, disco interiora, crebre uniserialia; *filamenta* brevia, compresso-subulata, apice incurva, pilosa; *antheræ* oblongæ, 4-sulcatæ, in sinu cordato basifixæ, 2-loculares, pilosulæ, primum poris 2 magnis apicalibus, demum rimis lateralibus dehiscentibus. *Ovarium* in sterilibus, quadratim disciforme, depressum, in fertilibus ovatum, toro semiimmersum, 4-loculare; ovula in quoque loculo 2; *stylus* brevis, subulatus; *stigma* obtusum, obscure 4-lobum. *Fructus* exsuccus, bacciformis, globosus, piperis mole, 4-locularis, pericarpio crustaceo, dissepimentis membranaceis. *Semina* in quoque loculo 2, superposita, angulato-triquetra, angulo centrali hilo parvo medio affixa; *integumentum externum* nitidum, crassiusculum, mesodermide gelatinosa mox siccata repletum, exappendiculatum; *integumentum secundum* osseum, extus valde tuberculatum, imo crassiore, et hinc foramine minuto in locellum parvum vacuum pro raphe intrusa perforatum; *integumentum internum* submembranaceum, coloratum, *chalaza* magna orbiculari signatum; *albumen* subovatum, imo truncatum, carnosum; *embryo* inclusus; *cotyledonibus* subfoliaceis, ovatis, *radicula* tereti ad micropylen spectante longioribus.

Arbores *Tasmanicæ*, *Nova-Zelandicæ et Chinenses;* folia *subopposita*, *ovata*, *serrata vel integra*, *petiolata;* flores *ramoso-*

paniculati, vel intra bracteas solitarii, subracemiformes, axillares, parvi.

1. *Friesia peduncularis*, DC. Prodr. i. 520; Bot. Mag. lxxii. tab. 4246;—Elæocarpus peduncularis, *Lab. Nov. Holl.* ii. 15, tab. 155.—In Tasmania.
2. *Friesia racemosa*, A. Cunn. in Ann. Nat. Hist. ser. 1. vol. iv. p. 23; Hook. Icon. vii. tab. 601;—Elæocarpus dicera, *Vahl. Symb.* iii. 67;—Dicera? serrata, *Forst. Prodr.* 227; *DC. Prodr.* i. 520; *A. Rich. Fl. Nov. Zel.* 304:—Aristotelia racemosa, *Hook. fil. Fl. N. Zel.* i. p. 33.—In Nova Zelandia.
3. *Friesia fruticosa*;—Aristotelia fruticosa, *Hook. fil. l.c.* p. 34. —In Nova Zelandia.
4. *Friesia Chinensis*, Gardn. & Champ. in Hook. Kew Journ. i. 243.—In ins. Hong Kong.

3. VALLEA.

This genus, proposed by Mutis, was first established by Linnæus, in the Supplement to his 'Systema.' Its floral characters were figured and described in the 'Flora Peruviana;' and the genus was afterwards better illustrated by Kunth. Most botanists have placed *Vallea* in the *Elæocarpeæ*; but the authors of the new 'Genera Plantarum' have arranged it in their tribe *Sloaneæ*, on account of the "subligneous muricated capsule." But there is very little resemblance in the pericarp of this genus to that of *Sloanea* and its allied genera, where, in a dry capsular fruit, the valves are thick, ligneous, and densely covered with long spines or rigid hairs. It is not correct to say that the pericarp of *Vallea* is *muricated*; on the contrary, the fruit is baccate, the mesocarp being thick, soft, and fleshy, covered by a thin membranaceous epicarp, which is corrugated in the form of many fleshy obtuse tubercles; this dries upon the testaceous endocarp after the fall of the fruit, when it becomes imperfectly dehiscent at its summit. I have seen the fruit in an unripe state only, when the seeds have not been sufficiently perfected to ascertain the nature of the integuments; but a longitudinal section through the centre shows that the edges of the dissepiments are firmly agglutinated upon a solid central column that rises to three-quarters of the length of the cells, the remaining upper portions being separated by a hollow space; and it is this which limits the small extent of the apical dehiscence of the fruit when it becomes quite dried. This structure is analogous to that in *Tricuspidaria*; but there the axile column scarcely rises above the base; so that the edges of the dissepiments, being unrestrained, admit of a considerable extent of divarication of the valves. In *Aristotelia* this central column rises to two-thirds of the length of the cell; but the endocarp is of too thin a texture to give sufficient elasticity to the parts, after they become dried, to cause its dehiscence. It will appear, therefore, that *Vallea* ought to stand close to *Aristotelia*, as it possesses all the essential characters of the *Elæocarpeæ*: it has the calyx and petals of *Friesia*, a disk very different from any of the *Sloaneæ*, the stamens, ovary, style, and stigma as in *Aristotelia*. It has, however, one peculiarity in sometimes having stipules, which do not seem to be known in other genera of the *Elæocarpeæ*; nor do they exist in the *Sloaneæ*; but this appears to be only a partial feature in the genus.

I have drawn up an amended character of *Vallea* from my own observations.

VALLEA, Mutis.—*Flores* hermaphroditi. *Sepala* 5, oblonga, acuta, marginibus lanuginosis, æstivatione valvata. *Petala* 5, sepalis paulo longiora, membranacea, obovata, fere ad medium 3-loba, marginibus supersessis, æstivatione imbricata. *Discus* crassus, in annulos 2 fossa intermedia constrictus, exteriore plano, margine undulato toro adnato, interiore subcupulæformi, margine elevato et crenulato, intervallo staminigero. *Stamina* 40, in seriebus 2, in constrictione disci crebre disposita; *filamenta* linearia, complanata, superne tenuiora, puberula, apice incurvata; *antheræ* lineares, sub-4-gonæ, antice et postice profunde sulcatæ, basifixæ, 2-loculares, apice utrinque poro obliquo angulato dehiscentes. *Ovarium* conico-rotundum, 3–4-sulcatum, 3–4-loculare, loculis 3-ovulatis; *ovula* subreniformia, axe centrali affixa, superposita: *stylus* filiformis, erectus, stamina æquans, glaber; *stigmata* 3–5, subbrevia, teretia, subdivaricata. *Fructus* baccatus, globosus (pericarpio succulento, in tubercula plurima elongata obtusa carnosa corrugato, endocarpio lævi), 3-locularis, siccus dehiscente ad apicem brevissime ac loculicide 3-valvatim aperiens: *semina* pauca, ignota. Arbores *Neogranadenses et Peruvianæ, frondosæ;* folia *alterna, ovato-oblonga, subcordata, integra, petiolata, interdum stipulata,* stipulis *parvis, reniformibus, geminis;* paniculi *axillares et terminales, pedicellis bracteatis.*

1. *Vallea stipularis*, Mutis in Linn. f. Suppl. 266; DC. Prodr. i. 520; H. B. K. v. 349, tab. 489.—In Santa Fé de Bogota: *v. s. in herb. Mus. Brit.* (Mutis).

   This plant is very well described and figured by Kunth.

2. *Vallea pubescens*, H. B. K. v. 350;—ramulis teretibus, ni-

grescentibus, junioribus ferrugineo-tomentosis; foliis ovato-oblongis, imo subrotundis, vix cordatis, apice subobtusis, integris, e basi 3–5-nerviis, nervis conspicuis, reticulato venosis, supra nitidis, glaberrimis, subtus flavido-glaucis, undique præsertim in axillis nervorum molliter ferrugineo-pubescentibus; petiolo tenui, fere glabro, limbo dimidio breviore; stipulis geminis, reniformibus, fere sessilibus, extus parce puberulis: paniculis axillaribus, folio paulum brevioribus, rufo-puberulis, bis dichotome divisis, cum flore in dichotomiis; pedicellis incrassatis, bracteolis minimis, caducis; fructu carnoso, tuberculato, globoso, pisi majoris mole.—In Nova Granada et Peruvia: *v. s. in herb. meo*, Peru (Mathews, 3048); *in herb. Mus. Brit.*[*]

3. *Vallea cordifolia*, R. & P. Syst. Fl. Per. 132; Prodr. 75, tab. 14; DC. Prodr. i. 520;—ramulis teretibus, junioribus rufo-tomentosis; foliis elongato-oblongis, imo cordatis vel truncatis, sursum gradatim angustioribus, longiuscule acuminatis, marginibus sæpius sinuatis, supra obscure viridibus, nitentibus, glabris, nervis tenuibus, reticulatis, subtus fusco-ferrugineo-glaucis et undique præsertim in nervis rufo-pubescentibus; petiolo subtenui, tereti, parce puberulo, limbo 3-plo breviore; stipulis deficientibus et forsan nullis: paniculis in ramulis junioribus subterminalibus, pubescentibus, laxe dichotome divisis, cum flore in dichotomiis; bracteis foliolosis; pedicellis crassissimis; stigmate 5-fido.—In Peruvia: *v. s. in herb. meo*, Peru (Mathews, 892); *in herb. Mus. Brit.*

The leaves in this species are 4–4½ inches long, 2¼–3 inches broad, on a petiole 1¾ inch long. No stipules can be discovered in any of the specimens I have seen, although DeCandolle states their presence, perhaps under a mistake: they are not mentioned by Ruiz & Pavon.

4. *Vallea glabra*, n. sp.;—ramulis teretibus, glabris; foliis imo truncatis (non cordatis), ovatis vel obovatis, subpanduræformibus, apice obtusule ac breviter attenuatis, integris, 3-nerviis, supra pallide viridibus, nitentibus, reticulatis, subtus pallidissime flavo-glaucis, glabris (nisi axillis nervorum quæ barbatæ sunt), nervis venisque nudis, stramineis; petiolo tenuissimo, glaberrimo, imo apiceque paululum incrassato, limbo dimidio breviore; manifeste exstipulatis: paniculis glaberrimis, terminalibus, bis dichotome divisis, cum flore in dichotomiis, pedicellis apice incrassatis; sepalis

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[*] This species, with ample details, is figured in Plate 81.

glabris, marginibus intus lanatis; stigmate 3-fido.—In Peruvia: *v. s. in herb. meo*, Prov. Chachapoyas (Mathews).

This is a distinct species, hitherto undescribed, approaching the last in the want of stipules. Its leaves are 2½–3 inches long, 1½–1¾ inch broad, on a petiole 1¼–1½ inch long. The terminal panicle is 1½ inch long, pedicels 2–2½ lines long; sepals 2 lines long; stigma 3-fid.

4. TRICUSPIDARIA.

There are many points of analogy between this genus and *Aristotelia*; but it differs in its solitary and much larger flowers upon lengthened peduncles, in their being always hermaphrodite, in having a tubular calyx, more fleshy petals, longer stamens arranged uniserially on the summit of a tall cylindrical disk or gynophore that supports the ovary, in its long subulate style, its capsular fruit, and in its seeds. In *Aristotelia* the hilum is upon the middle of the ventral edge of the seed; in *Tricuspidaria* it is at one extremity, the other being deficient of the horny appendage. The outer tunic is less fleshy, more friable, and easily separating when dry, leaving the chord of the raphe upon the second integument or bony shell, extending from one extremity to the other, where it is lost in the large truncated chalaza. There are two species, both natives of Chile, one of which I examined attentively, many years ago, in the living state. The following is an amended and more amplified generic character, founded upon my own observations.

TRICUSPIDARIA, R. & P.—*Flores* hermaphroditi. *Calyx* urceolato-tubulosus, submembranaceus, margine breviter sinuato-5-dentatus, demum irregulariter dirupto-lobatus et deciduus. *Petala* 5, æqualia, cuneato-oblonga, concava, imo subsaccata, intus usque ad medium carinata, apice in denticulos 3 acutos incisa, calyce 3-plo longiora, carnosa, imo disci inserta, æstivatione e marginibus longitudinaliter late inflexis introplicato-valvata, decidua. *Discus* in forma gynophori alte cylindraceus, profunde 10-sulcatus, ovarium fulciens, persistens. *Stamina* 15, petalis æquilonga, uniserialiter summo disci inserta, ovarium crebre circumstantia; *filamenta* filiformia, compressa, pilosula, superne paulo divaricatim curvata; *antheræ* his dimidio breviores, lineares, 4-sulcatæ, summo filamentorum geniculatim affixæ, apice conniventes, collateraliter 2-loculares, loculis vertice e poris 2 confluentibus, brevissime 2-valvatim dehiscentes. *Ovarium* disco superpositum, elongatum, apice conico-subcylindricum, 3–4-sulcatum, 3–4-loculare: *ovula* in quovis loculo 12–16,

per paria angulo centrali horizontaliter affixa; *stylus* ovario æquilongus, tenuiter subulatus; *stigma* obtusulum aut vix ullum. *Capsula* ovata, 3–4-quetra, angulis undulatis, stylo acuminata, disco persistente stipitata, 3–4-locularis, ultra medium loculicide patentim dehiscens, dissepimentis medio valvarum affixis, ad axin solutis, margine seminiferis, columna centrali nulla. *Semina* in quoque loculo 4–8, biserialia, obovata, subangulata, una extremitate *hilo* minimo notata, altera rotundata; *integumentum externum* nitidum, nigrum, carnosulum, sicco fragile et facile desiliente, *raphen* ab hilo ad chalazam in forma chordæ longitudinalis includens; *tunica secunda* obovata, subossea, imo incrassata et truncata, hinc foramine intra locellum vacuum (pro raphes transitu) perforata, apice mamilla parva apiculata, lævis, opaca, pallida; *integumentum internum* submembranaceum, fulvum, imo chalaza magna orbiculari notatum, apice micropyle punctatum: *albumen* obovatum, prope chalazam truncatum, carnosum; *embryo* inclusus, fere æquilongus, *cotyledonibus* ovatis, compressis, *radicula* tereti ad hilum spectante 4-plo longioribus.

Arbores *Chilenses*, *sempervirentes*, *frondosæ;* folia *subopposita*, *oblonga*, *glanduloso-serrata*, *breviter petiolata:* flores *speciosi*, *albi*, *majusculi*, *solitarii*, *axillares*, *longe pedunculati.*

1. *Tricuspidaria dependens*, R. & P. Prodr. Fl. Per. 64, tab. 36, Syst. p. 112; DC. Prodr. i. p. 520;—Tricuspis dependens, *Pers. Ench.* ii. p. 9;—Arbor frondosa, ramis divergentibus, alternis, rarius suboppositis, teretibus, glabris, ultimis brevibus, rigide spiniformibus et foliolosis; foliis subalternis, rarius oppositis, subparvis, ovatis, utrinque obtusis, coriaceis, marginibus subrevolutis, crebre glanduloso-serratis, supra læte viridibus, glaberrimis, subtus pulverulento-glaucis; petiolo brevissimo, glabro, limbo 10-plo breviore: floribus axillaribus, solitariis, subbreviter pedunculatis, folio paulo brevioribus; calyce irregulariter rupto, demum deciduo; petalis subcoloratis, extus pulverulento-tomentosis: capsula disco stipitata, depresso-trigonoidea, lævi, subcarnosa, valvarum marginibus planis.—In Chile prov. australioribus: *v. s. in herb. Mus. Brit.* (spec. typ. Ruiz & Pav.); Concepcion (Dombey).

There can be no doubt in regard to the identity of this species, with which the following has been confounded. It is an evergreen tree, about 20 feet high, with a trunk about a foot in diameter, growing in moist places and on the sides of rivers in the provinces of Concepcion and Itata, with pendent branches

which reach the ground and there sometimes take root; it has much smaller leaves than the following species, more divaricating and shorter branchlets (often like leaf-bearing spines), extremely short petioles, and smaller flowers. The leaves are generally 9 lines, sometimes 15 lines long, 6–8 lines broad, on a petiole 1–1¼ line long; the peduncle is 8 or 9 lines long; the flowers have a very sweet smell; the calyx, 2 lines long and broad, becomes lacerated to the base, and soon falls off; the petals are darker, 6 or 7 lines long; the filaments are 3 lines, the anthers 2 lines long; the ovary is conically oblong, somewhat puberulous, and, together with its long pointed subulate style, is 5 lines long; the capsule is 5 lines high, 7 lines broad, smooth and subfleshy (not transversely corrugated), 3-valved, the margins of the valves being straight and flattened.

2. *Tricuspidaria Patagua*, nob.;—Tricuspidaria dependens, *Hook.* (*non R. & P.*) *Bot. Misc.* iii. p. 156; *Gay, Chile*, i. p. 338;—Crinodendron Patagua, *Mol.* (*non Hook.*) *Hist. Chile*, pp. 146 & 290; *Cav. Diss.* 300, tab. 158;—Arbor frondosa, ramis elongatis, subascendentibus, teretibus, striatellis, cinereis, brevissime tomentellis; foliis sæpius oppositis, oblongo vel lanceolato-oblongis, imo cuneatis, apice rotundatis aut obtusis, coriaceis, marginibus subrevolutis, sinuato-serratis, dentibus glanduloso-mucronulatis, supra pallide viridibus, glaberrimis, nitidis, subtus glaucescentibus et præsertim in nervis prominulis arcuatim nexis parce puberulis, petiolo canaliculato, flavido-pubescente, limbo 8-plo breviore: floribus solitariis, axillaribus, longe pedunculatis, folio paulo brevioribus; calyce campanulato, margine demum lacerato, ab ovario in forma annulari secedente pedunculum circumdante prolapso; petalis niveis, carnosis, majusculis, intus usque ad medium valde carinatis, marginibus introplicatis; capsula disco stipitata, ovata, utrinque acuta, subtrialata, marginibus valde undulatis, coriacea, transversim corrugata, seminibus nigris, nitentibus. —In Chile prov. centralibus: *v. v. et sicc.* (Bridges, 159).

This is a handsome tree, about 30 feet high, also evergreen, growing in drier situations in all the central provinces, extending even into the deep valleys of the Cordillera, and everywhere known by the name of "Patagua:" it produces a timber of much utility and of considerable size—according to Molina, sometimes 7 feet in diameter; but I never heard of any approaching so large a size. Its leaves are from 1¼–2½ inches long, 8–12 lines broad, on a petiole 3 lines long; the peduncle in flower is 8–10 lines long, in fruit 12 lines long, gradually thickening upwards, and 5-sulcate; the calyx is $1\frac{1}{2}$ line long, 2 lines in diameter, seceding from the summit of the pedicel and remaining strung upon it, in the form of a fimbriated annular disk; the petals are 7–8 lines long; the capsule is 6 lines long and broad, pointed at each extremity, opening upon the sharp, sutural, much undulated edges of the valves, which, curving back horizontally, show the seeds attached to each side of the margin of the dissepiments; the pyriform seeds are 2 lines long, $1\frac{1}{2}$ line in diameter *.

5. Crinodendron.

This name was given to the well-known Patagua of Chile by Molina, who described it so imperfectly that Ruiz and Pavon did not recognize it when they founded their genus *Tricuspidaria* upon the same plant. Molina gave Cavanilles a rough drawing, showing the flower and seed, made from memory, which the latter described and figured in his 'Dissertationes,' the characters there assigned to it being altogether erroneous. Sir William Hooker, in 1833, described a plant from the island of Chiloe, collected by Cuming, which he supposed to be the same as that incorrectly described by Molina and Cavanilles, and accordingly named it *Crinodendron Patagua.* In giving an outline of its generic character, he wrongly described the flower as having no calyx, which had fallen away from Cuming's specimens; the inflection of the petals was not noticed; and the remarkable glands were not observed upon the disk, which was figured as being simply columnar. Gay, in his 'History of Chile,' erroneously describes the calyx; but he gives an account of the structure of the fruit, which was not known previously. *Crinodendron* cannot be said to have existed as a genus until Sir William Hooker first established it in his 'Botanical Miscellany;' and he, perceiving its near affinity to *Tricuspidaria*, placed it in the *Elæocarpeæ*, notwithstanding the then apparently discordant characters of its floral envelopes. De Candolle has not noticed the genus; but Endlicher placed it in his tribe *Tricuspidariæ*, in association with *Vallea* and *Tricuspidaria.* Bentham and Hooker, in their 'Nova Genera,' have regarded it as a synonym of *Tricuspidaria*, evidently unaware of the characters which separate it from that genus. The following is an amended diagnosis, according to my own observations, as far as regards the floral structure; not having seen the ripe fruit,

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* A figure of this species, with full structural details, is shown in Plate 82.

I have copied the details in that respect from Gay's work, where alone it is described.

Crinodendron, Hook. (non Mol. nec Cavan.).—*Flores* hermaphroditi. *Sepala* 3, distincta, æqualia, obovata, apice 2-dentata, dentibus rotundatis, parallele nervosa, utrinque adpresse pilosa, æstivatione paulo imbricata, valde caduca. *Petala* 5, oblonga, sepalis plusquam duplo longiora, extus convexa, imo breviter saccata, lateribus inflexis, apice breviter et acute 3-dentata, carnosula, suberecta, extus glabra, intus in nervis parallelis prominulis pilosula, æstivatione introflexo-plicata, dentibus valvatis, mox decidua. *Discus* in forma gynophori late columnaris, centralis, extus in glandulas 10 parallelas oblongo-ovatas inciso-sulcatus, coloratus, persistens. *Stamina* 20, æqualia, summo disci circa ovarium uniseriatim inserta; *filamenta* tenuissime linearia, imo paulo latiora, subcurvata, brevissime hispida; *antheræ* longe lineares, 4-sulcatæ, scabridulæ, geniculatim basifixæ, apicibus conniventes, antice et postice profunde sulcatæ, 2-loculares, vertice e poris 2 confluentibus brevissime 2-valvatim serius longitudinaliter dehiscentes. *Pollen* minute globosum. *Ovarium* ovatum, disco stipitatum, sulcatum, velutino-pilosum, 5-loculare; *ovula* 24–30 in quovis loculo, crebre 3-seriatim axe centrali affixa: *stylus* subulatus, erectus, subtenuis, 5-sulcatus, subglaber; *stigma* obsoletum. *Capsula* (sec. cl. Gay) subrotunda, grosse bullata, coriacea, velutina, 4–5-locularis, loculicide dehiscens; *semina* in quovis loculo 3–4, superposita, axi affixa, rotundo-pyriformia, subangulata; *testa* crustacea: *embryo* in albumine subtenui corneo-carnoso orthotropus; *cotyledones* plani, suborbiculares, *radicula* brevi, supera.

Arbor *Chilensis et Chiloensis, frondosa, sempervirens;* folia *sublanceolata, glanduloso-serrata, breviter petiolata:* flores *speciosi, aurantiaci, majusculi, solitarii, axillares, longissime pedunculati.*

1. *Crinodendron Hookerianum*, C. Gay, Flor. Chile, i. p. 341; —Crinodendron Patagua, *Hook.* (*non Mol. nec Cav.*) *Bot. Misc.* iii. p. 156, tab. 100;—Arbor frondosa; foliis suboppositis vel subternis, lanceolato-oblongis, utrinque obtusis aut subacutis, marginibus valde revolutis, remote serratis, dentibus longe glanduloso-mucronatis, supra pallide viridibus, subtus flavido-glaucis, in axillis nervorum fasciculato-barbatis, nervis arcuatis prominentibus, petiolo limbo 12-plo breviore costaque pubescente: floribus axillaribus, solitariis, cum pedunculo apice incrassato pubescente 2–3-plo longiore folia subæquantibus; sepalis utrinque puberulis; petalis

carnosulis, aurantiacis, glabris, sepalisque mox deciduis; ovario flavide tomentoso; stylo subulato, ad medium piloso; capsula ovato-globosa, majuscula, grosse bullata, tomentosa, 4–5-sulcata, 4–5-loculari, apice breviter loculicide dehiscente; seminibus in loculis 3 vel 4, majusculis; testa crustacea.—In Chile prov. Valdivia et in insula Chiloe: *v. s. in herb. meo*, *Mus. Brit.*, *et Hook.*, Valdivia (Bridges, 613); Chiloë (Capt. King; Cuming, 22).

An evergreen tree, 8–16 feet high, with a trunk 8 inches in diameter: leaves 1¾–4 inches long, 5–12 lines broad, on a petiole 1½–2 lines long; peduncle 1¼–1¾ inch long, gradually thickening to the summit; sepals 4 lines long, 3 lines broad, free and attached to the margin of the thickened apex of the peduncle, each with seven parallel nervures; petals 9–11 lines long, 4–5 lines broad, including the inflected margins, with three apical teeth 1 line long, glabrous; columnar disk 1 line high, 2 lines in diam., glabrous; filaments 3 lines, anthers 5 lines long, scabridly rugulose; ovary 3 lines long, 2 lines broad; style 4–7 lines long; capsule 8–10 lines in diameter; seeds at least 2 lines in diameter, attached to the central column*.

OBSERVATIONS ON SOME OF THE HELIOTROPIEÆ.

In the 'Prodromus' of De Candolle we find the order *Borragineæ* divided into four distinct tribes, the *Cordieæ*, *Ehretieæ*, *Heliotropieæ*, and *Borrageæ*. Long before the appearance of that work, the late Mr. R. Brown had pointed out, in his 'Prodromus,' p. 492, that the *Cordieæ* ought to be held as a distinct family, on account of their 4-fid style, and their seeds without albumen, with plicated cotyledons—an opinion supported by Endlicher and Lindley for reasons which appear sufficiently valid. Von Martius rightly held that the perfectly gynobasic style, placed in the middle of four distinct ovaries, entitled the *Borrageæ* to rank as a separate natural order, and accordingly he combined the two remaining tribes of DeCandolle, the *Ehretieæ* and *Heliotropieæ*, in another family, which he designated with the name of *Ehretiaceæ*. The uncertainty and confusion in the distribution of the species in these several groups have in great measure arisen from a neglect to examine the structure of the fruits; it may, however, be taken as a rule that among the whole of them it is essential that the seeds should be suspended and solitary in their respective cells, with a superior radicle. But it is important to notice that Gaertner distinctly attributes to *Bourreria*, and figures, a 4-carpellary fruit, with seeds having an inferior radicle; and Kunth describes his South-American species of *Ehretia* (formed into the genus *Amerina* by De Candolle) as having a unilocular ovary, with four ovules attached to two bifid opposite parietal placentæ—structures only reconcileable with *Verbenaceæ*: indeed De Candolle appeared so far disposed to adopt this view that he suggested the latter genus might be allied to *Tectona*. *Amerina*, however, appears much nearer *Callicarpa*, with which it agrees in its tubular persistent calyx, its cylindrical 5-lobed corolla, with five exserted stamens, the ovary and seed being formed as above indicated, having also an arborescent habit with opposite leaves. The doubts that have been thrown upon the truth of Kunth's observations concerning *Amerina* and of Gaertner's regarding *Bourreria* are only inferences founded upon analogy; but no one has yet shown by actual examination that the statements of those botanists are contrary to fact.

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* A representation of this plant, with particulars of its floral structure, is seen in Plate 83 A.

It is difficult to draw a line of distinctive characters between the *Ehretieæ* and *Heliotropieæ*: some have suggested a suffruticose habit in the former, and a subherbaceous one in the latter; but these characters are too variable to be of use: others have urged the presence of albumen and a bifid style in the former, and the want of albumen with an undivided stigma in the latter; but the former character has been denied to *Ehretieæ* by De Candolle, and I have to show the existence of a deeply cleft stigma in *Heliotropieæ*. De Candolle places *Tournefortia* in *Ehretieæ*; Fresenius, who has elaborated the Brazilian *Borragineæ*, ranks that genus in *Heliotropieæ*, and with reason. To the latter tribe has also been assigned the distinctive character of a scorpioid spicated inflorescence; but that character is rendered nugatory by the presence of solitary axillary flowers in *Coldenia* and in many species of *Schleidenia*, and of several congested single axillary flowers in *Tiquilia*. There remains, therefore, scarcely a tangible uniform character that can mark the limit between *Ehretieæ* and *Heliotropieæ*.

In regard to *Ehretia* I will not venture to offer any decided opinion, because I have had no opportunity of examining its species; but we are evidently much in the dark concerning its real structure. All authors agree in attributing to *Ehretia* a 4-locular ovary with a slender simply 2-fid style, a single ovule suspended from the summit of each cell, and a baccate fruit enclosing a 4-celled nut, or two nucules, each 2-celled. But Dr. Wight, in his 'Icones,' in pl. 1383 obscurely, and in pl. 1382 distinctly figures in *Ehretia* a bifid style upon an ovary which is 1-locular, with two opposite bipartite parietal placentæ, each fork bearing a single ovule, as in *Ægiphila* and *Amerina*. If these figures be correct, we must infer either that these species cannot belong to *Ehretia*, or that the characters of the genus have been erroneously defined, and the tribe itself has been placed in a wrong family. These discrepancies show that we have yet much to learn in regard to the *Ehretieæ*. If we hold *Bourreria* still in doubt, as well as *Amerina*, for the reasons before given, there will remain only *Ehretia* itself to represent the tribe; and this offers so many anomalous characters that DeCandolle considered it must ultimately be divided into several genera, of which he traced the outlines in *Bourreria*, *Carmona*, *Xerodema*, and *Menais*. *Xerodema* has been shown to be identical with *Rhabdia*, a Brazilian genus minutely and accurately described by Prof. von Martius in his 'Nova Genera,' and since figured by Sir Wm. Hooker (Icon. 823). This construction, of a 1-locular ovary, with two opposite 2-lamellar placentæ bearing an ovule on each of their reflected margins, and a fruit with four nucules, each with a longitudinal open slit leading into two cells, is quite at variance with the structure that has been attributed to *Ehretia* and its allied genera. I will offer some observations upon *Rhabdia* and *Cortesia* under separate notices.

The following is a synopsis of the genera of the *Heliotropieæ* :—

1. Fructus baccatus; albumen distinctum.
A. Pyrenæ 2, singulæ 2-loculares.
a. Embryo rectus; stamina inclusa; stylus brevis; stigma latum, breviter 2-lobum.............. *Tournefortia.*
B. Pyrenæ 4, singulæ 1-loculares.
b. Embryo lunatim curvatus; corollæ laciniæ subulatæ; stamina inclusa; stylus longiusculus; stigma majusculum, apice conico, piloso ...... *Messerschmidtia.*
2. Fructus exsuccus; albumen distinctum, aut nullum.
C. Pyrenæ 2, singulæ 2-loculares; stamina inclusa.
c. Stigma breve, vix divisum; albumen nullum.... *Heliophytum.*
d. Stigma magnum, elongatum, profunde 2-fissum; albumen distinctum........................ *Cochranea.*
D. Pyrenæ 2, singulæ 2-loculares.
e. Stamina longe exserta; stylus tenuis; stigma tenuiter 2-fidum .... *Tiquilia.*
E. Pyrenæ 4, singulæ 1-loculares.
f. Antheræ apice papilloso cohærentes; stylus brevis aut subnullus; stigma magnum; flores interdum solitarii et axillares .... *Schleidenia.*
g. Antheræ glabræ, oblongæ, liberæ; stylus mediocris; stigma magnum; flores in spicas longas curvatas terminales, 1-laterales .... *Heliotropium.*
h. Antheræ glabræ, globosæ, liberæ; stylus simplex, 2-fidus; flores axillares, solitarii .... *Coldenia.*

Pentacarya, Hook. & Arn., and *Euploca*, Nutt., appear to be foreign to this group. *Piptoclaina*, Don, differs little from *Heliotropium*, except in its four broadly margined 1-celled nuts, frequently reduced to two by abortion; it has five distinct sepals (not a tubular 5-toothed calyx, as Don states); it has the habit of *Coldenia*, but with terminal solitary spikes. *Halgarnia*, Gaud., also appears alien to this group, because of its campanular calyx and its incompletely 2-celled ovary with two pairs of collateral ovules suspended from two semiseptiform placentæ. As the genera *Cochranea* and *Messerschmidtia* hitherto appear almost unknown, I will here define them and note their species.

COCHRANEA.

This genus, proposed by me in 1825, upon a Chilian plant, was afterwards described as a variety of the *Heliophytum stenophyllum*, Hook. & Arn. It differs from *Heliophytum* in the peculiar habit of the plants (being short, erect, branching shrubs); they have more woody (not fistulose) branches, which are generally covered with numerous very fasciculated linear leaves; the genus also is remarkable for its very long conical stigma, two or three times the length of the style, or even longer, having a broad annular peltate enlargement at its base, and cleft at the summit, generally halfway down, into two narrow subulate segments, which are entire, or more rarely 2-denticulated. The fruit consists of two bilocular nucules, as in *Heliophytum*; but they have not the same deep vacuities on the inner face, and the seeds are enveloped in a distinct albumen. The inflorescence is not in long, solitary or geminate spikes, as in *Heliophytum*, but is corymbosely branched, at first in subglobose heads, afterwards becoming more spread.

COCHRANEA, nob.;—*Heliotropium* et *Heliophytum* in parte auct.—*Sepala* 5, lanceolata, erecta, plus minusve pilosa, æstivatione imbricata, persistentia. *Corolla* hypocrateriformis, *tubo* cylindrico vel supra medium paulo infundibuliformi, fauce plicis 5 angustato, sub-5-gono, nervis 5 crassis a medio loborum in angulis tubi decurrentibus et intra faucem sæpe glandulis totidem munitis, *limbo* expanso, vix ad medium 5-lobato, lobis rotundatis cum plicis totidem alternantibus, æstivatione valde imbricatis. *Stamina* 5, inclusa, fere sessilia, tubi dimidia longitudine: *filamenta* brevissima, circa medium tubi affixa; *antheræ* lanceolatæ, 2-lobæ, mucronatæ, imo breviter auriculatæ, in sinu dorsaliter affixæ, erectæ, utrinque rima laterali dehiscentes. *Discus* parvus, hypogynus, margine crenulatus. *Ovarium* hoc impositum,

subglobosum, 4-sulcatum, 4-loculare, loculis *ovulo* solitario suspenso munitis: *stylus* teres, superne paulo incrassatus; *stigma* inclusum, valde elongatum, imo annulo crasso cinctum, sursum attenuatum, plus minusve profunde 2-fissum, laciniis subulatis, integris, vel 2-denticulatis. *Fructus* exsuccus, globosus, profunde 2-sulcatus, calyce persistente inclusus; *nuculæ* 2, semiglobosæ, marginibus rotundatis, facie subplana, foraminulo obsoleto incavatæ, osseæ, singulæ 2-loculares, loculis 1-spermis. *Semen* ovatum, apice suspensum; *integumenta* tenuissima; *albumen* parcum, carnosum; *embryo* orthotropus, *cotyledonibus* ovatis, subcompressis, carnosulis, *radicula* tereti ad summum spectante duplo longioribus.

Suffrutices *Chilenses, dumosi, odore balsamico scatentes, ramosi;* ramis *sæpe virgatis, valde foliosis;* folia *in axillis alternis plurima, fasciculata, sæpius anguste lineares, marginibus interdum valde revolutis:* panicula *terminalis, primum subcapitata, demum expansa, valde ramosa, ramis breviter divisis et spicatifloris;* flores *parvi,* 1-*laterales, sessiles ebracteati.*

1. *Cochranea conferta,* nob. Trav. Chile, ii. 529;—Heliophytum stenophyllum, var. rosmarinifolium, *DC. Prodr.* ix. 552; *Gay, Chile,* iv. 456;—ramis strictiusculis, erectis, breviter pauciramulosis, in junioribus viscoso-pilosulis, demum glabris, confertissime imbricatim foliosis; foliis in axillis alternis, plurimis et fasciculatis, anguste linearibus, imo spathulatis, sessilibus, marginibus valde revolutis, supra subrugulosis, glabris aut obsolete puberulis, subtus parce rigido-pilosis: paniculis terminalibus, corymbosis; ramis alternis 3–4, spicas plurimas alternas gerentibus; floribus sessilibus, uniserialibus; stigmate stylo 2-plo longiore, fere ad medium 2-fido, laciniis subulatis, obtusulis.—In Chile: *v. v.* ad Cuesta larga de Llaillay; *v. s. in herb. variis* (Cuming, 377; Bridges, 235); *in herb. Hook.,* Coquimbo (Harvey), ex Mus. Paris. Chile (Gay).

I found this plant in 1822 in the province of Quillota, where it is frequent upon the lofty hills, forming a bushy shrub from 3 to 5 feet in height. Its erect branches are densely covered with crowded, imbricated leaves, fasciculated in the approximated axils; they are 14–18 lines long, ½ line broad. The terminal inflorescence, when fully developed, has a main peduncle 1½–2 inches long, bractless, expanding into three or four alternate branchlets, 9 lines long, divided into three or four others bearing many crowded sessile flowers arranged unilaterally in a spike; the sepals are 1¼ line long, obtusely

subulate, glabrous, with ciliated margins; the tube of the corolla is 2 lines long, glabrous, with five glands in its mouth; the border is 2½ lines in diameter, white, with red nervures, becoming pink when faded; the stamens, half the length of the tube, reach its mouth; the ovary is 4-grooved, seated on a crenulated disk; the style is about the same length; the stigma, double that length, is annulated at its base, conical, and simply 2-fid to nearly its middle*.

Var. *auriculata*;—caulibus erectis, rugosis; foliis creberrime divaricatis, imbricatim tectis; ramulis paucis, fuscis, granulato-papillosis; foliis in axillis approximatis circiter 10, longe linearibus, sessilibus, imo latioribus et subauriculatis, marginibus subsinuatis, subrevolutis, supra glabris: paniculis terminalibus, corymbosis; stigmate stylo æquilongo, apice 3-dentato.—In Chile: *v. s. in herb. Hook.* (Lobb, 442).

A plant with the habit of *C. congesta*, differing in its more crowded, more divaricated, longer leaves. It is probably a distinct species intermediate between *C. congesta* and *C. sinuata*, differing extremely from the latter in its habit, its longer, narrower, and more crowded leaves. The leaves (generally eight or ten in each approximated axil) are 1½–2 inches long, 1 line broad, quite glabrous above, with subsinuated margins, are minutely puberulous or pulverulent below, when examined under a strong lens; the peduncle and its branches are pubescent; the acute-lanceolate sepals are pilose on both sides; the cylindrical tube of the corolla is angular and pilose; the stigma (rather longer than the style) is somewhat conical, and 3-denticulated at its apex. In Bridges's No. 1838, referred by De Candolle to *H. myosotifolia*, where I have placed it, the stigma is invariably as I have there described it; but here it is constantly 3-lobed or imperfectly 4-denticulate, as De Candolle mentions. There is probably some confusion in the specimens.

2. *Cochranea corymbosa*, n. sp.;—valde ramosa; ramis brunneis, rugosis; ramulis longis, adscendentibus, subflexuosis, epidermide rubente laxa rimosa nitente vestitis; foliis majoribus fasciculatis, late lanceolatis, acumine brevi obtusulo, in petiolum longum imo dilatatum sensim cuneatis, planis, submembranaceis, tenuissime nervosis, utrinque subglabris, rugulosis, versus marginem et in costa subscabrido-pilosis: paniculis in ramulis terminalibus, corymbosis, glabris; pedunculo longissimo, compresso, rubente, nitido, superne alternatim et subremote ramoso; ramulis apice bis

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* A drawing of this plant, with ample analytical details, is shown in Plate 53 A.

dichotome divisis, ultimis tenerrimis, unilateraliter spicatifloris; floribus majusculis, inferioribus breviter pedicellatis, reliquis sessilibus; sepalis lanceolatis; stigmate stylo æquilongo, conico, fere ad basin 2-fisso, laciniis subulatis, obtusulis.—In Chile: *v. s. in herb. Mus. Brit. et Hook.*, Coquimbo (Bridges, 1341).

This species is at once distinguished from all the others by its much larger, flat, submembranaceous leaves. It seems to be a low-growing shrub with ascending branches, with branchlets 3–4 lines apart, which are subangular, subcompressed, 4–6 inches long, with axils 4–6 lines apart, which are somewhat nodose; the leaves (including the petiole, 7 lines long and ½ line broad) are 2 inches long, 3–3½ lines broad, the narrow petiole being somewhat enlarged at its insertion upon the node; within this, three or four shorter leaves are fasciculated in each axil; they are all nearly glabrous. The terminal peduncle is 4 inches long, bearing at intervals of 3 to 9 lines several branches 6–12 lines long, each divided into two unilateral spikes 1½ inch long, bearing sessile flowers 2 lines apart; the sepals, almost glabrous outside, are pubescent within and on the margins, are 2 lines long, acutely lanceolate; the tube of the corolla is 3 lines long, ½ line broad, with a border 5 lines in diameter; the anthers, 1 line long, are inserted 1¼ line above the base; the pistil is the length of the sepals, the style being rather longer than the stigma, and twice the length of the ovary.

3. *Cochranea sinuata*, n. sp.;—subdichotome et tortuose ramosissima, ramis ramulisque glabris, epidermide laxa fusca rimosa vestitis, junioribus pilosulis; foliis in axillis plurimis, fasciculatis, linearibus, apice rotundatis, imo in petiolum angustum longe spathulatis, marginibus undulato-sinuatis, sæpe subrevolutis, submembranaceis, supra rugulosis, in nervis impresso-sulcatis, obsolete pilosis, subtus pallidioribus, plus minusve cano-pilosis: paniculis terminalibus, subcorymbosis, alternatim ramosis, ramis geminatim divisis et spicatifloris; stigmate stylo paulo longiore, imo annulato, conico, granulatim viscoso, ad medium 2-fisso, laciniis 2-denticulatis.—In Chile: *v. s. in herb. Mus. Brit.*, Coquimbo (Bridges, sine num°.); *in herb. Hook.*, Coquimbo (Bridges, 1342).

This is evidently a low-growing shrub, with erect branches, which, in the lower portions, are nearly bare of leaves, very rough, with tortuous branchlets again divided, the younger ones being 5 or 6 inches long. The leaves are 9–14 lines long (including a petiole of 3 lines), 1½–2 lines broad, with very sinuous and undulated margins. The many approximated floriferous branchlets form a large corymbose head: each terminal panicle has a peduncle 4 lines long, with four alternate branches 3–4 lines apart, 4 lines long, each divided into two spikes 1½ inch long; the sepals are 1 line long, oblong, obtuse, pilose outside; the tube of the corolla is 1½ line long, with a border 4 lines in diameter; the pistil is 1 line long, the stigma being a little longer than the style.

4. *Cochranea stenophylla*;—Heliophytum (Heliotropium) stenophyllum, *Hook. & Arn. Beech. Voy.* 66; *DC. Prodr.* ix. 552; *Gay, Chile*, iv. 456;—caulibus erectis, longiusculis, vix flexuosis, subnudis, nodis prominulis ruderatis, superne valde ramosis; ramulis plurimis, alternatim approximatis, divaricatis, griseis, glabris, paucifoliosis et puberulis; foliis fasciculatis vel rarius solitariis, linearibus, utrinque attenuatis, crassiusculis, supra breviter sparsim tuberculato-pilosis, subtus adpresse hirtulis: paniculis terminalibus, subcorymbosis, pilosis; pedunculo ramos 3–4 alternos breves spicatifloros gerente; floribus majusculis, crebriter sessilibus; stigmate stylo æquilongo, imo incrassato, conico, fere ad basin 2-fido, laciniis 2-dentatis.—In Chile: *v. s. in herb. Mus. Brit. et Hook.*, Coquimbo (Bridges, 1340).

These specimens have a somewhat flexuous knotty stem, 1 foot long, above which they throw out several close ascending branches, 4–10 inches long, with several divaricating branchlets, at distances of 6–9 lines, and about 4 inches long. The leaves are 5 lines long, ¾ line broad; the terminal peduncle, 6–9 lines long, bears three alternate short curving spikes, each with about six flowers, all forming a corymbulose head; the sepals, 1¾ line long, ½ line broad, are linear, pilose on both sides; the tube of the corolla is 2 lines long, a little swollen in the mouth, pilose on its angles, with a border 4 lines in diameter; the pistil is 1½ line long, the stigma as long as the style, cleft for nearly half its length into two obtuse segments, which are minutely 2-denticulated at their apex.

The original typical specimen is not to be found in the Hookerian herbarium.

5. *Cochranea myosotifolia*;—Heliophytum stenophyllum, var. myosotifolium, *A. DC. Prodr.* ix. 552; *Gay*, *Chile*, iv. 456; —ramosa, ramis subtortuosis, irregulariter diffusis, crebre nodosis, epidermide rimoso, griseo; ramulis teretibus, griseo-puberulis; foliis in axillis alternis, plurimis, fasciculatis, linearibus, imo paulo attenuatis, apice obtusulis, utrinque

adpresse scabrido-pilosis, marginibus subrevolutis; inflorescentia terminali, pubescente; pedunculo 2-fido, in ramos dichotome spicatifloros diviso; floribus crebriter sessilibus; stigmate stylo brevissimo 8-plo longiore, imo incrassato, sursum acutissime conico, ad medium 2-fisso, laciniis subsetaceis.—In Chile: *v. s. in herb. Mus. Brit.*, Coquimbo (Bridges, 1338).

This appears to be a low straggling shrub, with irregularly spreading branches covered with a glabrous splitting epidermis; the lower ones are knotty, with prominent leafless nodes; the upper branches are terete and pubescent, with axils 2–6 lines apart. The leaves are 8 lines long, 1 line broad; the peduncle of the terminal inflorescence is 9 lines long, its branches 3–4 lines long, each bearing two short spikes, all forming a corymbose head; the sepals are 2 lines long, acutely linear, pilose on both sides; the tube of the corolla is 1¾ line long, somewhat larger about the mouth, and pilose outside, with a border 3½ lines in diameter, with five radiating, broad, coloured nervures; anthers 1 line long, reaching the mouth; pistil 1½ line long, the ovary, style, and stigma being in the proportions of 3 : 1 : 8.

6. *Cochranea florida*;—Heliophytum floridum, *A. DC. Prodr.* ix. 553;—Heliotropium floridum, *Gay*, *Chile*, iv. 457;—e basi ramosissima, ramis subangulatis, ramulisque crebris, rufescentibus, glabris; foliis linearibus, obtusis, imo angustissime spathulatis, planis aut marginibus vix revolutis, utrinque subrugulosis, fere glabris aut versus margines obsolete pilosis: paniculis terminalibus, corymbosis, 1–3-ramosis, ramis spicatifloris; floribus sessilibus, majusculis; stigmate stylo fere æquilongo, imo annulato, apice 2-fisso, laciniis 2-dentatis.—In Chile: *v.s. in herb. Hook.*, Coquimbo (Cuming, 858; Bridges, sine numº.); ex Mus. Paris. (Gay).

A low-growing shrub, with subcrect or decumbent stems, with ascending, very approximated branches, covered with a lax, reddish, shining epidermis; leaves 8–10 lines long, 1–1½ line broad, decurrent on a petiole of one-fourth their length; peduncle of terminal inflorescence 1 inch long; its branches, 3 or 4 lines apart, are bare at base, spicated unilaterally, with few sessile flowers; the acutely lanceolate sepals, pilose on both sides, are 2½ lines long; the tube of the corolla is pentagonous, glabrous, 3 lines long, the expanded border 5 lines in diameter; the stamens occupy the upper half of the tube; the pistil is 2½ lines long; the conical stigma, annular at base, is cleft for one-third or one-fourth of its length into two segments, 2-denticulate at their apex. In Bridges's specimen the flowers are paler and smaller, and the leaves narrower.

7. *Cochranea hebecula*, n. sp.;—ramosissima, ramis griseis, creberrime ramulosis, ramulis junioribus dense sericeo-pubescentibus, incanis; foliis fasciculatis, oblongo-linearibus, imo in petiolum angustissime spathulatis, apice rotundatis aut obtuse attenuatis, carnosulis, subplanis, utrinque incano-pilosulis, eveniis: paniculis corymbosis, terminalibus, 2–3-spicatis; floribus majusculis, 1-serialibus; stigmate stylo 6-plo longiore, 2-fido, laciniis 2-denticulatis.—In Chile: *v. s. in herb. Mus. Brit.*, Coquimbo (Bridges, sine num°.).

This appears to be a bushy plant, with knotted branches 3 lines thick, divided at their summit into numerous very close leaf-bearing ramifications, 8–10 inches long, with branchlets 4–6 inches long; the axils are 3–6 lines apart; the leaves 8–12 lines long, 1 line broad; the terminal peduncle is 6 lines long, sometimes bearing a single spike, 2 inches long, or with two or three alternate spicated branches 3–4 lines apart, much shorter, bearing a few large flowers 1 line apart; calyx 1 line long, cleft nearly to the base, where it is shortly cupuliform, with five acutely oblong segments, densely pilose on both sides; the tube of the corolla 1¼ line long, 5-gonous, somewhat pilose outside, with a border 4 lines in diameter; pistil somewhat longer than calyx; stigma annular at base, six times as long as the style, cleft for one-third of its length into two broadish bidenticulate segments.

8. *Cochranea ericoidea*, n. sp.;—ramosissima, ramis ramulisque tenuissimis, divergentibus, pallidis, glaberrimis aut molliter puberulis, axillis cupula brevissima obtusa prominula foliigera munitis; foliis pluribus, fasciculatis, parvis, linearibus, sessilibus, apice callosis, carnosulis, enerviis, supra pilis rigidulis, imo tuberculatis scabridulis, subtus costa et marginibus subrevolutis scabridule hirtellis: paniculis terminalibus, pilosis, sæpius geminatim spicatifloris; floribus sessilibus, minoribus; stigmate longissimo, incluso, 2-fido, laciniis obtusis.—In Chile: *v. s. in herb. Mus. Brit. et Hook.*, Coquimbo (Bridges, 1339).

This appears to be a low straggling shrub, with very slender divaricating branches, having much the habit of an *Aloysia*; the lower branches are quite smooth and bare; the foliiferous branchlets are very slender, scarcely more than ¼ line in thickness, nodose at the axils, with a very short obtuse spine, produced by the persistent base of the midrib of the exterior leaf: out of these cupular nodes, which are 2–3 lines apart, three or four leaves spring, which are 3–5 lines long: the peduncle is 2–3 lines long, with geminate or three alternate spikes 3 lines apart, 1–1½ inch long, rigidly and shortly pilose; the sessile flowers are 1–2 lines apart; the sepals, ¾ line long, are connate at base into a short cup, with oblong segments, callous at the apex, fleshy, pale green, pilose on both sides; tube of corolla 1 line long, wider and pilose above, with a border 2 lines in diameter; pistil the length of tube of corolla, with a subglobose sulcated ovary seated on a 10-lobed disk; the stigma, annular at base and as broad as the ovary, six times as long as the style, tapering to an obtuse point, cleft for a quarter of its length into two obtuse segments.

9. *Cochranea filifolia*, n. sp.;—ramosissima, ramis teretibus, nodosis, epidermide grisea rugulosa tectis, striatellis; ramulis alternatim approximatis, subadscendentibus, glabris, junioribus papilloso-tomentosis; foliis in axillis, plurimis, inæqualibus, fasciculatis, rarius solitariis, spathulato-linearibus, parvis, crassiusculis, granuloso-rugosis, divergentibus: paniculis floribundis, in ramulis terminalibus, glanduloso-puberulis; pedunculo bis dichotome diviso, ramis ultimis tenuibus, spicatifloris; floribus sub-2-seriatis, remotiusculis, sessilibus; sepalis brevibus, extus farinaceo-leprosis; stigmate imo lato, conico, profunde 2-fido, laciniis obtuse 2-dentatis.—In Chile: *v. s. in herb. Mus. Brit. et Hook.*, Coquimbo (Bridges, 1343).

These specimens of Bridges's collection, though under the same number as *C. chenopodiacea* in M. de Boissier's herbarium, are specifically very distinct from it. The plant is everywhere covered with a resin-like minute granulation; the leaves are more than twice the length and narrower than those in the species referred to: it is somewhat ericoid in its habit, with the young branchlets terete, fulvous, and rugulose, 6–8 inches long, with axils 3–4 lines apart. The leaves are 3–6 lines long, ½ line broad. The peduncle of the terminal inflorescence is ¾–1 inch long, twice dichotomous, the ultimate branches spicated, 2 inches long, with about eight rather large sessile flowers, 3–4 lines apart, all forming a corymbose panicle; the sepals are ¾ line long, obovate, obtuse, erect, fleshy, covered with whitish leprous scales, glabrous within; the tube of the corolla is cylindrical, 1 line long, the border being 3–4 lines in diameter; the ovary, subglobose, 4-grooved, is seated on a lobed disk; the stigma is six times as long as the very short style, has a basal ring broader than the ovary, is shortly conical, obtuse, cleft halfway into two obtuse 2-dentate segments: the fruit, consisting of two nuts enclosed in the persistent calyx, is polished and glabrous.

10. *Cochranea hispidula*, n. sp.;—crebre ramosissima, ramis subrugoso-striatis, ramulis subdivergentibus, teretibus, bruneis, pilosis; foliis fasciculatis, sessilibus, spathulato-linearibus, obtusis, marginibus valde revolutis, carnosulis, fusco-viridibus, undique hispidulis; paniculis in ramulis terminalibus, brevibus, bis dichotome divisis, pubescentibus; ramis ultimis 2-seriatim spicatifloris; floribus paucis, crebris, sessilibus; stigmate stylo 6-plo longiore, apice 2-fido, laciniis 2-dentatis.—In Chile boreali: *v. s. in herb. Hook.* (Lobb, 440).

This is evidently a low-growing shrub, with extremely crowded, elongated branchlets, 3–4 lines apart, 8 or 9 inches long, the lower ones again branching, the upper ones simple: the axils are 3 lines apart; the leaves are 4–6 lines long, ½ line broad. The peduncle of the inflorescence is 6 lines long, its branches 6 lines long, their ultimate 2- or 3-spicated branchlets being 9 lines long; the calyx is tubular, cleft halfway into five erect teeth, is pubescent on both sides, 1 line long; the tube of the corolla is 1 line long, pubescent outside, with a border 2 lines in diameter; the pistil is 1 line long; the stigma, eight times the length of the style, annular at base, slenderly conical, cleft for a quarter of its length into two bidentate segments.

11. *Cochranea chenopodiacea*;—Heliophytum chenopodiaceum, *A. DC. Prodr.* ix. 553;—Heliotropium chenopodiaceum, *Gay, Chile*, iv. 458;—nana, divaricato-ramosissima, glabella; ramulis subrigidis, teretibus, flavidulis, junioribus obsolete puberulis; axillis cupula prominente munitis; foliis fasciculatis, parvis, spathulato-linearibus, subteretibus, marginibus valde revolutis, carnosulis, fere sessilibus, glabris vel subviscosis: paniculis terminalibus, bis dichotome divisis, ramis ultimis tenuibus, spicatifloris; floribus paucis, sessilibus, pallide cæruleis; calyce tubuloso, 5-dentato, extus pilosulo; stigmate stylo 2-plo longiore, apice obtuso, breviter bifido.—In Chile: *v. s. in herb. Hook. ex Mus. Paris.*, prov. Copiapo, ad montes Arqueros (Gay).

This plant was found by Gay in the more northerly province of Copiapo, in the silver-mining district of Arqueros, and is distinct from the plant I have referred to *C. filifolia*, which has been confounded with it. Gay says it is a low shrub, not more than a foot high, with many short stiff spreading branches, which are terete, covered with a yellowish, shining epidermis. The fasciculated leaves are very small, somewhat glutinously rugulose, 1 or 2 lines long, scarcely ¼ line broad; the terminal inflorescence has its spicated branchlets 6 lines long; the calyx is broadly tubular, 1 line long, cano-pubescent outside, divided halfway into five triangular teeth; the tube of the corolla is a trifle longer than the calyx, cylindrical and pilose outside; the pistil is as long as the tube of the corolla; the ovary semiglobose, seated upon the disk; the stigma, annular at base, is rather longer than the style, conical, and divided at its apex into two short obtuse segments. The glabrous fruit consists of two nucules, each 2-celled.

MESSERSCHMIDTIA.

The late Mr. Robert Brown (in 1810) pointed out the necessity of constituting a distinct genus for those species of *Tournefortia* which differed from all the others in having the border of the corolla cleft into subulate lobes, a baccate fruit containing four nucules (each unilocular and monospermous), the seed with a very curved embryo and a superior radicle (Prodr. p. 496); but he omitted giving a name to the genus. In 1819 Römer and Schultes adopted this view, calling the genus *Messerschmidtia*, a name previously given by Linnæus to those species of *Tournefortia* which have a fruit with two nucules, each 2-celled. As such characters, according to their showing, belonged to *Tournefortia* proper, the *Messerschmidtia* of Linnæus naturally fell to the ground. Adopting it, therefore, for the group in question, they enumerated eleven species, all natives of the New World, mostly climbing or subscandent plants; but it is strange that among these there appears only one species that answers to the essential characters of their own generic diagnosis. G. Don (1837), following the same train, amplified the species to twenty-four, in total disregard of the distinguishing features of *Messerschmidtia*, associating with them several belonging to *Heliophytum*. Endlicher (1838) acknowledged the genus, and gave it a tolerably correct diagnosis, though with some few errors. By some authors the name has been applied to other very different groups, selected from *Tournefortia*; and this has caused no little confusion. DeCandolle, in his elaboration of the *Borragineæ* (in 1845), quite ignored *Messerschmidtia* as a genus, admitting neither that of Linnæus nor of Römer and Schultes; but he retained this name, as a section, for a small number of species of *Tournefortia* possessing very different characters (Prodr. ix. 528).

Fresenius (in 1857), in Mart. Flor. Bras., enumerated twenty-six Brazilian species of *Tournefortia*, among which are several belonging to *Messerschmidtia*; but he did not adopt this name, even as a section, apparently unaware of the peculiar structure of its fruit: the species of both these genera are therefore indiscriminately mingled together in that work. In order to clear away the mystification engendered by these several discordant views, it appears necessary to define the true limits of *Messerschmidtia* with greater accuracy—a task of no great difficulty, as I have found its characters constant in all the species I have examined. It may readily be distinguished from *Tournefortia* and *Heliophytum* by its four monospermous nucules, in which respect, however, it accords with *Heliotropium*; but it differs from all those genera in the greater length of its narrow acuminated sepals, in the narrow segments of the border of its corolla, which are cleft to the base, in the hippocrepiform duplicature of its carpels, in the depressed form of its 4-lobed fruit, in the extreme curvature of its embryo, and generally in its climbing habit. *Heliophytum* and *Heliotropium* differ in the very imbricated æstivation of the lobes of their corolla. In *Tournefortia*, where the lobes of the border are not cleft to the base, these are simply folded together in a plicato-valvate æstivation, while the intermediate plicatures in the sinus of the lobes make a fornix over the mouth of the tube. In *Messerschmidtia* the extremely narrow lobes of the border in the bud are quite involute by the rolling inwards of their margins, the æstivation being thus subvalvate, not by the margins, but by the juxtaposition of the rounded inflected surfaces of the lobes.

MESSERSCHMIDTIA, R. & Sch. (non Linn.).—*Sepala* 5, longe linearia, sæpe setiformia, erecta, tubum corollæ sæpe æquantia, persistentia. *Corolla* tubulosa, tubo angusto, plicis 5 longitudinalibus sulcato, cum angulis nervigeris, supra medium paululo inflato, fauce constricta, limbo ad basin 5-partito, laciniis linearibus vel anguste lanceolatis, stellatim expansis, æstivatione involutiva. *Stamina* 5, inclusa, infra faucem fere sessilia; *filamenta* brevissima, longe supra medium tubi orta, tenuia; *antheræ* obconice oblongæ, tubo 6-plo breviores, imo sagittatæ, dorso ad sinum affixæ, apicibus mucronatis pilosulis circa stigma fornicatim cohærentes, 2-loculares, loculis collateralibus rima longitudinali lateraliter dehiscentibus, glabræ. *Discus* parvus, hypogynus, margine crenulato. *Ovarium* conico-oblongum, in stylum gradatim angustatum, disco insitum, 4-loculare, loculis 1-ovulatis; *ovulo* suspenso. *Stylus* longiusculus, filiformis,

stamina attingens, glaber, apice incrassatus et turbinatus; *stigma* obtuse conicum, 4-sulcatum, pilosum. *Fructus* baccatus, parce carnosus, globose 4-gaster, depressus, in medio umbilicatus et styli vestigio notatus; *pyrenæ* 4, demum separabiles, dorso convexæ, intus angulatæ, hippocrepice plicatæ, carunculatæ, et hinc primum cohærentes, osseæ, indehiscentes, 1-loculares, 1-spermæ: *semen* hippocrepice curvatum; *integumentum* tenue; *albumen* parcum, carnosum; *embryo* conformis, *cotyledonibus* ovato-oblongis, foliaceis, incumbenter arcuatis, *radicula* supera ad stylum spectante 6-plo longioribus.

Suffrutices *Americani, plerumque Brasilienses, sæpius subscandentes;* ramis *tenuibus, sæpe fistulosis;* folia *alterna, petiolata, oblonga, integra, glabra, aut adpresse pilosa:* inflorescentia *axillaris et terminalis, divaricatim vel dichotome ramosa, ramis ultimis spicatifloris, apice recurvatis;* flores *parvi, 1-laterales, crebri, sessiles aut brevissime pedunculati, ebracteati.*

* Paniculæ axillares et subterminales.

1. *Messerschmidtia subulata*, Gardn. Lond. Journ. Bot. i. 532;—Tournefortia Gardneri, *A. DC. Prodr.* ix. 526; *Fresen. in Mart. Fl. Bras.* xix. p. 54;—Tournefortia lanceolata, *Fres. l. c.* p. 55;—scandens, ramulis teneribus, fistulosis, pilosiusculis; foliis oblongo-lanceolatis, acuminatis, imo rotundatis, submembranaceis, utrinque rugulosis et sparse adpresso-villosulis; petiolo pilosulo, limbo 12-plo breviore: paniculis axillaribus et terminalibus, pubescentibus, brevibus, crebre alternatim ramosis et spicatifloris; sepalis lobisque corollæ longe subulatis; baccis 4-gastris.—In Brasilia: *v. v.* prov. Rio de Janeiro (Jurujuba, Botafogo, et Rio Cumprido); *v. s.* Tejuco (Gardner, 175).

A slender climbing plant, frequent in the neighbourhood of Rio de Janeiro: its long slender branches are ½ line thick, with axils about 2 inches apart; leaves 2–3½ inches long, 9–14 lines broad, on a slender petiole 2–3 lines long; panicle ½ inch long, branching from the base with three or four alternate curving branches ½ line apart, each 6 lines long, with about twelve sessile flowers closely uniserial on the upperside; sepals 2 lines long, ¼ line broad at base, setiform, ciliate on margins; tube of corolla 2 lines long, pilose outside, a little swollen below the mouth; segments patent, very narrow, with inflected margins 3¼ lines long; stamens cohering in the mouth by their barbated summits; style long, slender, swollen above, with an annular ring terminated by a conical pilose apex;

fruit baccate, 4-lobed, depressed, with four nuts, as in the generic diagnosis.

2. *Messerschmidtia Martii*, nob.;—Tournefortia Martii, *Fresen. in Mart. Fl. Bras.* xix. p. 55;—subscandens, ramis teretibus, subglabris, in junioribus sparse pilosulis; foliis oblongis, imo rotundatis, gradatim angustatis, acutis, membranaceis, supra densius, subtus sparse strigoso-pilosis, pilis e tuberculis albis et adpressis; petiolo tenuissimo, pilosulo, limbo 8-plo breviore: paniculis axillaribus, laxis, bis dichotomis aut subpentastachyis, ramis subcompressis, valde divaricatis, pubescentibus, ultimis spicatifloris; floribus sessilibus, 1-serialibus, puberulis.—In Brasilia, prov. Bahia et Espirito Santo: *v. s. in herb. meo* (Rio Ilheos, Mart.).

A plant 10–20 feet high, with scandent or weak straggling branches scarcely a line in thickness, with axils 6–9 lines apart; leaves 2–3½ inches long, 1–1⅝ inch broad, on a very slender petiole 2½–3 lines long; peduncle 8 lines long, with two divaricating arms 5 lines long, each bearing two or three floriferous spikes 1½ inch long, with about ten or twelve somewhat distant flowers; sepals 1½ line long; tube of corolla 2 lines long, swollen below the mouth, segments narrow, 1 line long, with introflected margins; anthers cohering by their barbated summits; ovary glabrous, subglobular, distinctly 4-lobed; style swollen at its apex by a crenulated annular ring; stigma short, conical and papillose.

3. *Messerschmidtia Organensis*, nob.;—scandens, ramis pendentibus, flexuosis, fistulosis, angulato-compressis, glaberrimis; foliis oblongis, imo rotundatis, acute acuminatis, membranaceis, utrinque glaberrimis, marginibus subrevolutis; petiolo glabro, canaliculato, limbo 8-plo breviore; axillis plerisque floriferis: paniculis supra-axillaribus, foliis paulo longioribus, glaberrimis, longe et tenuiter pedunculatis, ebracteatis, alternatim ramosis, ramis laxis, tenuibus, spicatifloris; floribus remotiusculis, breviter pedicellatis; sepalis et lobis corollæ longe subulatis.—In Brasilia, prov. Rio de Janeiro: *v. v.* ad Imbuhy in montibus Organensibus.

I found this very distinct species in 1838, growing in virgin forests. The axils are 1¼–1¾ inch apart; the leaves are 2½–3 inches long, 10–13 lines broad, on a petiole 4–5 lines long. The panicles are always supra-axillary, 2½–3 inches long, completely glabrous, on a slender naked peduncle 1–1½ inch long, bearing eight or ten alternate slender patent spicated branches 6–9 lines long. The terminal panicle is pyramidal, 6 inches long, and compound, consisting of a great many alternate branches like the axillary panicles, but without leaves: the uniserial flowers are 1½–2 lines apart, each on a pedicel ½ line long; the sepals are 1 line long, glabrous, with ciliated margins; the tube of the corolla 2 lines long, its segments 1 line long; the anthers cohere by their papillose summits; the style is slender, enlarged at its summit, and terminated by an oval, obtuse, pilose stigma.

4. *Messerschmidtia Blanchetii*, nob.; Tournefortia Blanchetii, *A. DC. Prodr.* ix. 524; *Fresen. in Mart. Fl. Bras.* xix. 52;—scandens, ramis teretibus, adpresse sericeis; foliis ovatis, acutissime acuminatis, imo obtusis, membranaceis, utrinque pilosis, subtus pallidioribus, nervis parum distinctis, petiolo limbo 10-plo breviore: paniculis axillaribus et terminalibus, divaricato-dichotomis, subferrugineo-pubescentibus; floribus in ramis ultimis spicatim sessilibus, remotiusculis; sepalis lanceolatis, acuminatis, tubo corollæ sericeæ dimidio brevioribus; limbi lobis anguste linearibus.—In Bahia (Blanchet, 1914) (*non vidi*).

A species much resembling *M. Salzmanni*. Leaves 2½–3 inches long, 20–24 lines broad, on a petiole 4 lines long; flowers 3 lines long.

5. *Messerschmidtia salicifolia*, Gardn. Lond. Jour. Bot. i. 181;—Tournefortia salicifolia, *DC. Prodr.* ix. 531; *Fresen. in Mart. Fl. Bras.* xix. p. 55;—scandens, ramis fistulosis, angulato-compressis, subflexuosis, molliter patenter pilosis; foliis oblongo-lanceolatis, lanceolatisve, imo obtusis, a medio sensim acuminatis, supra molliter pilosulis, subtus ferrugineo-glaucis, tomentoso-villosulis, marginibus ciliatis; petiolo patenter, ferrugineo-villoso, limbo 12-plo breviore: paniculis axillaribus et terminalibus, folio longioribus et suboppositis, bis dichotome geniculatim divisis, ramis alternatim ramosis et spicatifloris, villosis; floribus remotiusculis, sessilibus; sepalis lobisque corollæ acutissimis; drupis 4-gastris, pilosis.—In Brasilia ad Rio de Janeiro: *v. v. et s.* Morro de Flamengo (Gardner, n. 81).

A climbing plant, not uncommon in the neighbourhood of Rio de Janeiro, with branches 1–1½ line thick, geniculately flexuose at the axils, which are about 1 inch apart; the leaves are 2–4 inches long, 5–18 lines broad, on a petiole 2–3 lines long. The panicle, 2 inches long and broad, has a peduncle 6 lines long, its primary very divaricated branches 4 lines long, the secondary branchlets 3 lines long, each bearing two or three spikes 6–9 lines long, with about ten to fifteen sessile flowers ¾ line apart; sepals 1 line long, clothed with long hairs upon raised tubercles; tube of corolla 1 line long, with segments of equal length; anthers cohering in the mouth by their acuminated papillose summits; style glabrous, with a turbinated fringed summit, crowned by a short, oblong, pilose stigma.

6. *Messerschmidtia Vauthieri*, nob.;—Tournefortia Vauthieri, *DC. Prodr.* ix. 526; *Fresen. in Mart. Fl. Bras.* xix. 55;—scandens?, glaberrima, ramis angulato-sulcatis; foliis ellipticis, acuminatis, imo obtusis, petiolatis: paniculis axillaribus, ferrugineo-subvelutinis, folio dimidio brevioribus; sepalis corollæque lobis subulatis, tubo subvelutino dimidio brevioribus.—In Brasilia, in montibus Organensibus (*non vidi*).

From the above brief character, this species differs from *M. Organensis* in its always axillary panicles, of only half their length, and which are ferruginously velutinous; its leaves, somewhat smaller, have a comparatively longer petiole; and the flowers are pubescent. It is said to be near *M. macroloba*, but I have seen neither of them. Its leaves are stated to be 2½ inches long, 8–12 lines broad, on a petiole 3–5 lines long; the corolla is 2 lines long.

7. *Messerschmidtia floribunda*, G. Don, Dict. iv. 370;—Tournefortia floribunda, *H. B. K.* iii. 79; *Röm. & Sch. Syst.* iv. 541; *DC. Prodr.* ix. 527 (*non Fresen. in Mart. Fl. Bras.* xix. 51);—scandens, ramis teretibus, cano-tomentosis; foliis oblongis aut ovato-oblongis, acuminatis, imo rotundatis, supra tenuissime pubescentibus, subtus cano-tomentosis; petiolo teretiusculo, cano-tomentoso: paniculis axillaribus, dichotome multifidis, cano-tomentosis; spicis 20–24, filiformibus, diffusis; floribus unilateralibus, distantibus; sepalis corollæque lobis acuminato-subulatis; drupis glabris, 4-gastris.—In Cumana (*non vidi*).

Kunth does not state the length of the inflorescence or the size of the leaves; but their petioles are said to be 3 or 4 lines long. Fresenius has confounded with this species the *M. membranacea*, Gardn., which is a very different plant.

8. *Messerschmidtia macroloba*;—Tournefortia macroloba, *DC. Prodr.* ix. 527; *Fresen. in Mart. Fl. Bras.* xix. p. 55;—scandens?, glaberrima, ramis teretibus, superne obtuse angulatis; foliis elliptico-lanceolatis, longe acuminatis, imo subobtusis; petiolo limbo 12-plo breviore: paniculis axillaribus et terminalibus, puberulis, folio multo brevioribus; sepalis lineari-lanceolatis, corollæ tubo dimidio brevioribus,

corollæ lobis subulatis, patentibus, tubum æquantibus.—In Brasilia, Rio de Janeiro (Lotschy) (*non vidi*).

Leaves 4–5 inches long, 1½ inch broad, on a petiole 3–4 lines long. It is remarkable for the extreme length of the lobes of the border of the corolla.

9. *Messerschmidtia vicina*, nob.;—ramis teretibus, rugosis, lignosis; ramulis subcompressis, angulato-sulcatis, junioribus pallidis, glabris; foliis oblongis, imo obtusis, apice acuminatis, submembranaceis, supra sparse scabridulis, rigide adpresso pilosis, pilis brevibus e tuberculis majusculis albis enatis, subtus pallidioribus, rugoso-punctatis, glabris, costa tantum subpilosa; petiolo supra plano, scabridulo, limbo 12–18-plo breviore: racemis axillaribus, subglabris, geniculatim flexuosis; ramulis alternis, 3–4, gracilibus; floribus remotiusculis, parvis, sessilibus; baccis glabris, 4-gastris.—In Brasilia: *v. s. in herb. Mus. Brit.*, Penêdo, Rio S. Francisco (Gardn. 1362).

The leaves are 3–4½ inches long, 1⅛–1½ inch broad, on a petiole 3 lines long; peduncle of inflorescence bare, 9 lines long, geniculated at the axils of the alternate branches, which are 5–6 lines apart, and 2½ diminishing to 1 inch long; sepals very narrow, 1 line long.

10. *Messerschmidtia ramiflora*, nob.;—scandens, ramis laxe ramulosis, ramulis pendentibus, fistulosis, compressis, sulcatis, subglabris; foliis oblongis, vix lanceolatis, imo acutis aut subobtusis, apice acuminatis, nervis tenerrimis utrinque immersis, glaberrimis, nisi in costa parce puberula, fusco-viridibus, opace rugulosis, concoloribus; petiolo tenui, superne tomentoso, limbo 8-plo breviore: paniculis axillaribus, multiramosis, folium excedentibus, brevissime pubescentibus; pedunculo petiolo 3-plo longiore; ramis plurimis, alternis, longiusculis, simplicibus aut 2-fidis, uniserialiter spicatis; floribus remotiusculis, breviter pedicellatis; sepalis corollæque lobis longe subulatis.—In Brasilia: *v. s. in herb. Mus. Brit.*, Rio Parahybuna, prov. Minas Geraës (Gardner, 5037).

The axils are ¾ inch apart; the leaves 2¾–3¼ inches long, 1–1¼ inch broad, on a petiole 5 lines long; each axil is floriferous. The panicle is 3½–4½ inches long, upon a bare peduncle 1–1½ inch long, with many alternate branches 3 lines apart, 1–2½ inches long, often bearing a small leaflet at the base; flowers 1-serial, 1–2 lines apart, slightly pubescent; sepals 1¼ line long; tube of corolla 1¾–2 lines long, below glabrous, segments 1 line long; anthers cohering by their barbate sum-

mits; ovary, style, and stigma 1¼ line long, glabrous; style four times the length of the ovary, turbinate at its summit, with a fringed margin, supporting a pilose ovate stigma one-tenth of its length.

11. *Messerschmidtia valga*, nob.;—ramis teretibus, lignosis, lenticellatis, ramulis striatellis; foliis ovato-oblongis, imo obtusis aut in petiolum acutiuscule decurrentibus, apice subacuminatis, submembranaceis, utrinque pilis brevibus e tuberculis sparsim adpresse strigosis, supra nervis tenuibus nigris immersis, subtus paulo prominulis, livide glaucis; petiolo superne sulcato, pilosulo, limbo 5–6-plo breviore: paniculis axillaribus, folium æquantibus, parce pilosis, pedunculo petiolo æquilongo; rachi brevi, flexuosa, divaricatim bis dichotoma, aut tristachya; ramis rigidulis, spicatifloris; floribus 1-serialibus, remotiusculis; sepalis corollæque lobis longissime subulatis, valde pilosis.—In Brasilia: *v. s. in herb. Mus. Brit.*, Maceio (Gardn. 1363).

Its axils are ¾ inch apart; the leaves are 2¼–2¾ inches long, 1¼–1½ inch broad, on a petiole 5 lines long; peduncle of inflorescence 9 lines long, its two branches 4 lines long, the spicate branches, slightly curved, 1¾ inch long; the flowers 1½ line apart; pedicels ½ line long; sepals 1½ line long; tube of corolla 1¾ line, the segments 1¼ line long; anthers very short, cohering by their apices in the mouth of the tube; pistil 1½ line long; style six times as long as the stigma.

12. *Messerschmidtia minuta*;—Tournefortia minuta, *Bert. in DC. Prodr.* ix. 527;—scandens?, ramis virgatis, junioribus minute puberulis; foliis anguste lanceolatis, obtusis, scabridis, petiolatis: paniculis axillaribus, conjugatim ramosis, ramis spicatifloris; floribus remotis; sepalis lanceolatis, acutis; corollæ tubo medio coarctato, limbi lobis lanceolato-acuminatissimis; drupis 4-gastris.—In Jamaica (*non vidi*).

Leaves 1½ inch long, 3 lines broad.

** Paniculæ in ramis aut in ramulis terminales.

13. *Messerschmidtia microphylla*, nob.;—Tournefortia microphylla, *Desv. in Ham. Prodr.* p. 24 (*non Bert.*); *DC. Prodr.* ix. 528;—Tournefortia lucida, *Desf. Cat. Hort. Par.* p. 397 (*non Desv.*);—subscandens?, undique glaberrima, ramulis tenuissimis, teretibus, lenticellatis; foliis parvis, obovatis, imo rotundatis, a medio gradatim angustioribus, apice valde obtusis, submucronulatis, crassiusculis, obscuris, utrinque rugulosis; petiolo tenui, limbo 6-plo breviore: paniculis in ramulis terminalibus, suboppositifoliis, breviter puberulis,

bis dichotome divisis aut simplicioribus; ramulis spicatifloris, filiformibus; floribus minutis; sepalis corollæque lobis longe subulatis, puberulis.—In Antillis: *v. s. in herb. Mus. Brit.*, ins. S^a Cruz (Van Rohr).

This appears to be a slender plant, with somewhat trailing branches ½ line thick, with axils 4–6 lines apart; leaves 7–11 lines long, 5–6 lines broad, on a petiole 1½–2 lines long; the peduncle of the inflorescence is 3 lines long, its two branches 2 lines long, the spicated branchlets 6–12 lines long; the flowers 1¼ line long, on a pedicel ½ line long; the sepals somewhat shorter than the tube of the corolla, and its lobes the same length as theirs.

14. *Messerschmidtia volubilis*, Röm. & Sch. Syst. iv. 541; Don, Dict. iv. 370;—Tournefortia volubilis, *Linn. Sp.* 201 (*non R. & P.*); *DC.* (*in parte*) *Prodr.* ix. 523; *Lam. Dict.* v. 358, tab. 95. fig. 2 (*non* 1 *nec* 3); *Gaertn. Fr.* i. 365, tab. 76. fig. 2; *Fresen.* (*in parte*) *in Mart. Fl. Bras.* xix. 53;—scandens, ramulis tenuissimis, fistulosis, rufo-pubescentibus; foliis parvis, lanceolato-oblongis lanceolatisve, acutis, læte viridibus, utrinque scabridule rugulosis, supra laxe pilosis vel subglabris, subtus adpresse puberulis; petiolo puberulo, tenui, limbo 6-plo breviore: paniculis sæpius terminalibus, subpuberulis, bis vel ter dichotome divisis; ramis tenerrimis, valde divaricatis, spicatifloris; floribus breviter pedicellatis, parvis; sepalis laciniisque corollæ lanceolato-subulatis; drupis 4-gastri-globosis, centro depressis, glabris, subdiaphanis, 4-maculatis.—In Antillis: *v. s. in herb. Mus. Brit.* (ex hb. Miller.).

This very slender species is probably confined entirely to the Antilles; but many plants assigned to it should be excluded: Gardner's No. 1785, from Ceará, referred here by Prof. A. DeCandolle, is *M. Salzmanni*; and others included by Prof. Fresenius should in like manner be rejected,—for instance, var. *hirsuta*, from Bahia (Blanchet), and others from Rio de Janeiro (Schott, 4939) (D. 1595). Its branches are scarcely more than ¼ line in thickness, with axils 6–7 lines apart; the leaves are 12–15 lines long, 5–6 lines broad, on a petiole 2 lines long; the peduncle is 3 lines long, the primary and secondary branches 3 lines, the ultimate spikes 12–15 lines long. In Gaertner's figure the position of the nucule is reversed: the radicle of the embryo ought to point to the summit.

15. *Messerschmidtia velutina*, G. Don, Dict. iv. 370;—Tournefortia velutina, *H. B. K.* 379, tab. 201; *DC. Prodr.* ix. 524;

—scandens, ramis teretibus, cano-tomentosis; foliis ovato-oblongis, obtusule acuminatis, imo rotundatis aut acutiusculis, crassis, utrinque lanato-tomentosis, subtus albidis; petiolo cano-tomentoso, limbo 6-plo breviore: paniculis terminalibus, dichotomis; ramis plurimis, subalternis, diffuse divaricatis, spicatifloris, cano-tomentosis; floribus unilateralibus, remotiusculis; sepalis lanceolatis, pubescentibus; drupis hispidulis, 4-gastris.—In Mexico, prope Acapulco (*non vidi*).

Axils ¾–1 inch apart; leaves 3–3¼ inches long, 13–16 lines broad, on a petiole 6–7 lines long. The terminal panicle is diffusely divided into about ten unilateral spikes, 4–5 lines apart, each about 3 inches long, with sessile flowers 1–2 lines apart.

16. *Messerschmidtia spigelliflora*, nob.;—Tournefortia spigelæflora, *A. DC. Prodr.* ix. 525;—scandens, ramis teneribus, teretibus, fistulosis, patenter rufulo-pilosis; foliis elliptico-oblongis, acuminatis, acute mucronulatis, imo obtusis, membranaceis, utrinque albo-tuberculatis et sparse adpresso-pilosis, supra fusco-, subtus pallide viridulis, nervis tenuibus obscuris; petiolo dense piloso, limbo 12–15-plo breviore: panicula terminali, longiuscula, laxe 3–4-chotome divisa, geniculatim flexuosa, dense pilosa, ramis ultimis curvulis, spicatifloris; floribus crebre 1-seriatis, pilosis; sepalis lobisque corollæ acutissime subulatis.—In Guiana Britannica: *v. s. in herb. meo* (Schomb. 749).

A climbing plant, with slender branches ½–¾ line thick, with axils 1 inch apart; leaves 3–3½ inches long, 1¼–1½ inch broad, on a petiole 3 lines long; panicle 5 inches long and broad, with geniculated conjugated divisions widely spreading, three times dichotomously divided; peduncle 1 inch long; primary branches 6–20 lines, secondary 9 lines, spicated branches 1½ inch long; sepals 1¼ line long, tube of corolla narrow, straight, 3 lines long, lobes of border 1 line long; anthers included, cohering at their summits; style elongated, turbinately thickened at its apex, and surmounted by a rather long, obtuse, pilose stigma.

17. *Messerschmidtia membranacea*, Gardn. Lond. Journ. Bot. i. 181;—Tournefortia membranacea, *DC. Prodr.* ix. 530;—Tournefortia floribunda, *Fresen.* (*non H. B. K.*) *in Mart. Fl. Bras.* xix. p. 54;—scandens, ramis compressis, flexuosis, subfistulosis, ferrugineo-tomentosis; foliis ovato-oblongis, imo rotundatis aut subcordatis, apice acutis et breviter mucronatis, supra pilis brevibus rigide adpressis incanis crebre tectis, subtus pallidioribus, densius velutinis, in nervis costa-

que flavido-tomentosis; petiolo tomentoso, limbo 5–6-plo breviore: paniculis axillaribus et terminalibus, flavo-tomentosis, bis dichotome geniculatim divisis, ramis ultimis spicatifloris; floribus 1-seriatis, crebre sessilibus; sepalis laciniisque corollæ valde subulatis, tubo superne inflato; drupis 4-gastris, glabris.—In Brasilia: *v. v.* in prov. Rio de Janeiro, ad Botofogo; *v. s. in herb. variis*, ex eodem loco (Gardn. 82).

Prof. Fresenius makes this plant identical with Kunth's *Tournefortia floribunda*, which does not belong to *Messerschmidtia*; it differs in its compressed flexuous subfistulose branches, its acute (not acuminated) leaves, covered with short rigid hairs (not slenderly pubescent nor cano-tomentose beneath); it differs also in its longer style and stigma. In Kunth's plant the drupe is globular, containing four globose nucules. In this species the flattened branches are 1½ line broad, with axils 1–2½ inches apart; the leaves are 2½ inches long, 1½–1¾ inch broad, on a petiole 4–6 lines long: the panicle, widely expanded, is 4 inches long, on a peduncle 6 lines long; primary and secondary branches 9 lines long, tertiary spicated, 3–6 lines apart, each 9–18 lines long; sepals ½ line long; tube of corolla less than 1 line long, the rest all conformable to the generic character; drupes glabrous*.

18. *Messerschmidtia Salzmanni*, nob.;—Tournefortia Salzmanni, *DC. Prodr.* ix. 524; *Fresen. in Mart. Fl. Bras.* xix. p. 51;—scandens, ramis teretibus, fistulosis, subflexuosis, simplicibus aut breviter ramulosis, flavide aut ferrugineo-tomentosis, axillis subnodosis; foliis oblongo-lanceolatis vel lanceolatis, sensim acuminatis, imo rotundatis, supra pilis brevibus velutino-tomentosis, subtus pallidioribus, ferrugineo-tomentosis; petiolo superne canaliculato, dense ferrugineo-pubescente, limbo 9–10-plo breviore: paniculis in ramulis alaribus terminalibus, flavo vel ferrugineo-tomentosis, bis dichotome divaricato-divisis, ramis conjugatis vel simplicibus, ultimis spicatifloris; floribus remotiusculis, brevissime pedicellatis; sepalis laciniisque corollæ longe subulatis.—In Brasilia, prov. Bahia (Blanchet, 3787–3789, et Claussen, 412–419); *v. s. in herb. meo*, Ceará (Gardner, 1785); *in herb. Mus. Brit.*, Bahia (Luschnatt).

A plant with long tortuous scandent branches, with axils ¾–2 inches apart; leaves 2¼–3½ inches long, 1–1¼ inch broad, on a petiole 3–4 lines long; peduncle of inflorescence 5 lines,

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* A drawing of this plant, with sectional details to show the generic structure, is given in Plate 53 B.

two primary divaricating branches 6 lines long, bearing five alternate floriferous spikes 3 lines apart, 12–20 lines long; sepals ½ line, tube of corolla 1¼ line, segments 1 line long; anthers included, cohering by their summits; ovary glabrous; style slender, incrassated at the apex, and surmounted by a pilose elliptical stigma; drupes much depressed, deeply 4-lobed, 1½ line in diameter, glabrous, the nucules incurved, dorsally tuberculated.

*** Paniculæ terminales et subpyramidatæ.

19. *Messerschmidtia candidula*, nob.;—Tournefortia sericea, *DC.* (*non Vahl*) *Prodr.* ix. 524; *Fresen. in Mart. Fl. Bras.* xix. 54;—scandens, ramulis rectiuscule elongatis, teretibus, subfistulosis, molliter cano-tomentosis; foliis ovatis, brevissime acutis, imo rotundatis aut subcordatis, supra dense viridibus, rugulosis, sparse molliter sericeo-villosis, in nervis sulcatis, subtus dense albo-lanato-tomentosis; petiolo tomentoso, limbo 20-plo breviore: panicula terminali, anguste pyramidata, albo-tomentosa, alternatim breviter ramosa, cum ramulis brevissimis et approximatis, paucifloris; floribus minusculis, crebris, obsolete pedicellatis; sepalis corollæque laciniis lineari-setaceis, pubescentibus, tubo imo glabro, superne densissime villoso; drupis depresso-globosis, 4-gastris, pilosis.—In Brasilia: *v. s. in herb. meo*, Ceará (Gardn. 1078).

This plant has been referred to the *Tournefortia sericea* of Vahl, a species from the Antilles, known only from his short description. It differs from it in its leaves not being glabrous above, and being nearly sessile, in its much denser terminal and pyramidal inflorescence (not axillary and dichotomously divided). Its branches are nearly straight and simple, 1½ line thick, with axils ¾–1½ inch apart; the leaves are 1¾–2 inches long, 1–1¼ inch broad, on a petiole scarcely more than 1 line in length. The terminal inflorescence is not pedunculated, 2½ inches long, 1 inch broad, consisting of many alternate branches 1–2 lines apart, each with very crowded short floriferous branchlets 2–4 lines long; flowers on very short pedicels, crowded; sepals 1½ line long; tube of corolla 1¼ line long, lobes of border ½ line long; anthers cohering at their apex; the style, thickened at the summit, including the stigma, is ¾ line long; the drupe in its structure quite conforms to the generic character.

20. *Messerschmidtia villosa*, nob.;—Tournefortia villosa, *DC. Prodr.* ix. 524; *Fresen. in Mart. Fl. Bras.* xix. p. 52;—ramis teretibus, hirsutissimis; foliis ovatis, acuminatis,

supra sparse pilosis, subtus conferte fulvo-sericeo-villosissimis, petiolatis: paniculis terminalibus, divaricato-dichotomis, aut in ramis axillaribus 1-foliosis, divaricato-dichotomis, fulvo-hirsutissimis; sepalis laciniisque corollæ longe subulatis, villosis, tubi apice villosissimo.—In Bahia (Blanchet, 215, 821, 1151, 2202) (*non vidi*).

The leaves are 1⅝–2⅝ inches long, 1–1½ inch broad, on a petiole 3 lines long; sepals 2 lines long; tube of corolla 3 lines long.

21. *Messerschmidtia subsessilis*, Don, Dict. iv. 370;—Tournefortia subsessilis, *Cham. Linn.* viii. 119; *DC. Prodr.* ix. 521; *Fresen. in Mart. Fl. Bras.* xix. p. 53;—scandens, ramulis tenuiter rectiusculis, teretibus, rigidule ferrugineo-tomentosis; foliis divergentibus, elongato-obovatis, acute acuminatis, imo subrotundatis, utrinque ruguloso-punctatis, e tuberculis sparsim adpresse pilosis, nervis supra impressis, subtus costaque prominulis fulvo-pilosis; petiolo tenui, rufo-piloso, limbo 15-plo breviore: panicula terminali, subpyramidata, alternatim breviter laxe ramosa, ramis inferioribus rufopilosis, imo pluribracteatis, superne ramulos 4 alternos spicatifloros ebracteatos gerentibus, superioribus cum ramulis conjugatis floriferis, aut simpliciter spicatifloris; floribus pedicellatis; sepalis corollæque laciniis longe subulatis, pilosulis, tubo fauce contracta.—In Brasilia: *v. s. in herb. Mus. Brit.*, Pernambuco (Gardn. 1076).

The above plant agrees with Chamisso's description of this species: it is nearly allied to *M. Pohlii*. The slender branches have the axils 6–9 lines apart; the leaves are 2–2¾ inches long, 11–14 lines broad, on a petiole 2 lines long. The terminal inflorescence is 3 inches long; the alternate branches, 2–4 lines apart, are about an inch long; the pedicels are ½ line long; the sepals 1 line long; the tube of the corolla 1¼, the segments ¾ line long.

22. *Messerschmidtia Pohlii*, nob.;—Tournefortia Pohlii, *Fresen. in Mart. Fl. Bras.* xix. p. 52;—scandens, ramis subcompressis, fistulosis, rufo-pilosis; foliis ovatis vel oblongis, acute acuminatis, imo rotundatis, supra tomentosis, nervis flavo-pubescentibus, subtus rufescenti-tomentoso-velutinis; petiolo tomentoso, limbo 10-plo breviore: panicula terminali, pyramidata, alternatim divaricato-ramosa, ramis simplicibus et spicatifloris, aut iterum brevissime ramulosis, ramo inferiore sæpe 1-folioloso; floribus sessilibus, dense villosis; sepalis corollæque laciniis longe subulatis; drupis 4-gastris, glabris.—In Brasilia: *in herb. Imp. Vindob.* (Pohl,

3535); *v. s. in herb. Mus. Brit.*, mont. Organens. ad Imbuhy (Gardn. 546).

A very distinct species, having straight elongated branches, with axils 1½ inch apart; leaves 1½–3¾ inches long, ¾–2 inches broad, on a rather stout petiole 2–3 lines long; the terminal panicle is 6 inches long in flower, 8 inches long in fruit, with twenty to twenty-four alternate patent branches 4–6 lines apart, 1–2 inches long, diminishing upwards, bare at base, the lower ones again branched, the upper ones simply spicate; flowers 1 line apart; sepals rather fleshy, very pilose on both sides, 1¼ line long; tube of corolla fleshy, contracted in the middle, 1½ line long, its segments ¾–1 line long; anthers cohering in the mouth by their scabrid summits; ovary and style equal, glabrous; stigma short, conical, pilose, sub-2-lobed.

On the Genera Cortesia and Rhabdia.

Cortesia.

This genus was established by Cavanilles, in 1797, upon a plant collected by Louis Née in his overland journey from Chile to Buenos Ayres. His account of this little-known plant is upon the whole correct; but, as there are some points of structure unnoticed by him, I will here add the results of my own observations made from the living plant in 1825. I found two species—one in dry desert tracts in the neighbourhood of Mendoza, the other fifty miles to the eastward, in saline marshy ground, which is that described and figured by Cavanilles. This genus has been rightly placed in the *Ehretiaceæ*, with which it accords in its tubular calyx, exserted stamens, bifid style, and baccate fruit: it approaches *Tournefortia* in its baccate 2-pyrenous fruit, each nut being 2-celled; but it differs in its solitary flowers, in the singular appendages found between the calyx and corolla, in the absence of a hypogynous disk, in its long bifid style, and in its persistent campanular calyx. The following is an amended character of the genus, from my own observations.

Cortesia, Cav.—*Calyx* tubulosus, carnosus, extus pilosus, intus densissime sericeo-villosus, ore dentibus 10–15 teretibus obtusulis subinæqualibus glabris paulo divaricatis cum membranis brevibus interjectis donatus, demum subcampanulatim dilatatus et persistens. *Appendices* circa 5–10 inter calycem et corollam positæ, squamiformes, inæquales, membranaceæ, ovatæ, utrinque pilosæ, longe unguiculatæ,

quorum 1 vel 2 calycem paulo superant, unguibus filiformibus extus pilosis, aut interdum omnes brevissimæ et ideo inter pilos facile invisæ. *Corolla* tubulosa, glabra, membranacea, tubo calycem paulo superante, medio vel sub faucem angustato, limbo ad basin 5-partito, laciniis æqualibus, oblongis, apice rotundatis, subexpansis, æstivatione (cum uno axi remoto exteriore) imbricatis. *Stamina* 5, laciniis alterna; *filamenta* imo dilatata, superne teretia et flexuosa, infra faucem enata, et cum costas totidem prominentes continua, paulo aut longe exserta, erectiuscula, æstivatione induplicato-inflexa: *antheræ* oblongæ, obtusæ, imo breviter divaricatæ, introrsæ, in sinu dorsali affixæ, oscillatoriæ, 2-loculares, loculis ad connectivum latum collateraliter affixis, rima sublaterali dehiscentibus. *Discus* nullus. *Ovarium* superum, pyriforme, imo turbinato-stipitatum, e toro depresso ortum, subsulcatum, semiseptis 2 incompletis e parietibus oppositis protrusis, mox divaricatim bifidis, marginibus singulatim ovulum ambientibus et dein expansis, septa 2 parallela incompleta formantibus, hinc pseudo-4-loculare; *ovula* paulo sub apicem suspensa; *gynobasis* seu columella centralis septis intermedia, membranacea, imo ad apicem protensa, libera, demum ad pyrenas adhærens. *Stylus* elongatus, teres, fere ad medium 2-fidus, ramis divaricatis, apice reflexis, æstivatione recurvatis; *stigmata* clavata, tubatim dilatata, rugulosa. *Drupa* obovata, pericarpio subsicco, calyce cupulari semicincta, glabra, nitida, 2-pyrena, *pyrenis* plano-convexis, osseis, 2-locularibus, intus sub apicem marginibus utrinque late lamellatim inflexis et hinc in angulo sic abscondito foramine lineari pro vasorum introitu perforatis; *semen* in loculis solitare, funiculo laminiformi suspensum; *integumentum externum* albidum, opacum, tenuiter papyraceum, *raphe* tenui longitudinali angulo interno signatum; *integumentum internum* valde membranaceum, subpellucidum, imo *chalaza* parva inconspicua notatum; *albumen* tenuissimum, in forma membranæ distinctum; *embryo* oblongo-fusiformis, carnosus, *cotyledonibus* 2, interdum 3, plano-convexis, *radicula* conica ad summum spectante continuis et 3-plo longioribus.

Suffrutices *humiles in provinciis Argentinis locis salitrosis incoli, scabri, rugosi, valde ramosi;* folia *alterna, sessilia, cuneato-oblonga, apice profunde 3-dentata, crassa, enervia, pilis rigidis e tuberculis majusculis albo-crystallinis undique scabra:* flores *axillares aut revera in ramis novellis terminales, solitarii, breviter pedicellati.*

1. *Cortesia cuneata*, Cav. Icon. iv. 53, tab. 377; Lam. Dict.

Suppl. ii. 364, tab. 921; DC. Prodr. ix. 512;—suffruticosa, e basi ramosa, ramis adscendentibus, ramulisque tenuibus, subvirgatis, glabris, substriatis; foliis alternis, sessilibus, imo longe cuneatis, apice latioribus et 3-dentatis, dentibus æqualibus, acutis, majusculis, lateralibus incurvatim arrectis, mediano recurvatim deflexo, crasso-coriaceis, enerviis, supra glabris, opacis, subtus tuberculis crystallinis setigeris scabridis, sessilibus, e basi refractis; floribus solitariis, pedicellatis, sæpius terminalibus, rarius axillaribus; calyce extus hispido-pubescente, intus densissime albido-sericeo-piloso, ore dentibus 12–15 munito; appendicibus 5, quarum 1–2 tubum æquant; corolla glabra, tubo in media angustiore, limbo expanso, usque ad basin 5-partito, lobis ovato-oblongis, rotundatis; filamentis imo dilatatis, paulo sub faucem affixis, longe exsertis; antheris oscillatoriis; ovario glabro, imo distincte stipitato; stylo 2-fido, ramis divaricatis dimidio brevioribus; stigmatibus subcapitatis, glanduloso-rugosis; drupa nigra, nitida, calyce cupuliformi semivestita.—In prov. Mendozæ ad Corocorto, et alios locos in humidulis salitrosis: *v. v. et s. in herb. meo et Hook.*, *loc. cit.*(Gillies); in prov. Santiago del Estero, in salitrosis (Tweedie, 1157).

I found this plant growing near Corocorto, a village 130 miles east of Mendoza, in a swampy saline district, where it attains a height of 4 or 5 feet; it is much branched, with straightish, rather spreading or ascending branchlets, which are polished, glabrous, of a reddish colour, slender and substriated. The axils are 3–5 lines apart; the leaves 9–15 lines long, 5 lines broad across the three lobes, 2 lines broad immediately below them, thence tapering to the base; they are scabrid beneath, with large conical white crystalline tubercles, that bear on their apex a short rigid hair; the solitary flowers are axillary, on a pedicel 3 lines long; the tube of the calyx (3 lines long) has from twelve to fifteen erect terete teeth, ½–1 line long, connected at their base by a short plicated membrane: the five appendices form a simple whorl round the base of the corolla; one or two of them are spathulate upon an elongated slender claw 2–3 lines long and ¾ line broad at the apex; the others are sessile, setiform, 1 line long, all sericeously pilose outside, smooth inside; the tube of the corolla is 3½ lines long, the lobes of the border are 1¾ line long, 1 line broad; the filaments, fixed just within the mouth, are 2 lines long; the lower part of the style is 3 lines long, its branches 2 lines long; the drupe is ovoid, with a thin coriaceous covering having a saline taste, is 6 lines long, 5 lines broad, half-enclosed within the cupular cup of the persistent calyx; the two plano-convex nucules are 4 lines long, 3 lines broad, hard and osseous, each with two distinct cells with foraminal apertures as above described, each cell containing an appended seed covered by its colourless integuments; the embryo, enveloped in an extremely thin albumen, has two (sometimes three) equal cotyledons, which are three times the length of the conical superior radicle*.

2. *Cortesia microphylla*, n. sp.;—suffruticosa, humilis, e basi ramosa, ramis imo toruloso-tortuosis, ramulosis, ramulis brevibus, subflexuosis, angulatis, divaricatis, glabris; foliis minoribus, sessilibus, imo anguste spathulatis, canaliculatis, apice dilatatis et 3-dentatis, dentibus acutis, mediano recurvo, lateralibus arrectis, apicibus tuberculo setifero spinulosis, supra subglabris, subtus tuberculis crystallinis setigeris exasperatis, carnosulis, enerviis, horizontaliter patentibus; floribus e ramulis novellis axillaribus 2–4-foliolosis solitariis et semper terminalibus; calyce hispido-pubescente, intus densissime sericeo, ore dentibus 10, acutis, intus planis, extus carinatis, mucronatis, alternis paulo brevioribus; appendiculis 10, breviusculis, setiformibus, villosis, in verticillo corollæ basin cingentibus; corolla membranacea, glabra, tubo cylindrico, calycem æquante, lobis oblongis, rotundatis, suberectis, staminibus medio tubi affixis, paulo exsertis; stylo his longiore, ramis recurvis; drupa subglobosa, calyce ampliato lateraliter fisso semivestita.—Circa Mendozam, in desertam salitrosam: *v. v.*

This is a shrub of much smaller dimensions and of low straggling growth, collected at a place called the "Plumerillas," in the Travesia not far from Mendoza: it is somewhat prostrate, with several tortuous spreading branches, from 9 inches to a foot long; the younger branches are cinereous, very rough, and more flexuous than in the preceding species; the leaves are less than half the size of those of the other species, more shortly cuneated, horizontally spreading; its flowers are never axillary, always terminal upon short axillary branches ½–1 inch long, furnished with from two to four small leaves; the axils are much closer, only 1 or 2 lines apart. The leaves ordinarily are 3 lines (rarely 5 lines) long, 2 lines broad across the lateral teeth, ½ line broad immediately below them, and thence linear to the base. The pedicel of the terminal solitary flower is very short; the calyx (including the teeth ½–1 line long) is 3 lines in length, the teeth being of a long triangular form, flat inside, without any intervening membranes; the tube of the corolla is 3–4 lines long, the lobes of the border 2 lines long, 1 line broad; the filaments, dilated in the lower moiety, are fixed in the middle of the tube, 3 lines long, and therefore but little exserted; the ovary is 1 line in diameter, supported on a narrow stipitate support ¾ line long; the lower portion of the style is 3 lines long, its branches 2 lines long; the ten appendices (nearly equal in size, setiform, 1 line long) form an annular fringe round the base of the corolla. The drupe is more globular than in the preceding species, and the persistent calyx, which half encloses it, is split on one side to the base.

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* A drawing of this species, with analytical figures, is given in Plate 83 B.

Rhabdia.

This genus was founded by Von Martius, in 1826, upon a Brazilian plant which he described and figured in his Nov. Gen. ii. 136, tab. 195; he placed it in *Ehretiaceæ*, where also it has been arranged by De Candolle and other botanists. Fresenius, in his memoir published thirty-one years afterwards in the 'Flora Brasiliensis,' absolutely ignored the peculiar seminal structure, which had been so well described by Von Martius. His diagnosis of *Rhabdia* is very short and unaccountably incomplete; he merely regarded it as an aberrant genus between *Heliotropieæ* and *Cordiaceæ*. My own observations fully confirm the accuracy of the peculiar structure of the fruit and seed as it is minutely described in the work of Von Martius. The placentation of the ovary is like that of *Amerina*; that is to say, it is unilocular, with two opposite parietal divisions, which project inwards towards the centre, where they do not meet, but are bifidly spread and turned backwards, each margin having a single ovule near its margin. The fruit is a succulent drupe containing four nucules, evidently at first combined together in pairs, and afterwards free; upon one margin only of each nucule, always on the contiguous side of each pair, there is seen a fungous longitudinal line, which penetrates the cell through an open corresponding slit; and upon this fungous line the single seed is attached, at a small spot halfway between the middle and the summit: this fungous line seems to be a part of the central columella seen in the ovary. The seed is long, pointed at both extremities, and on its outer integument a line of raphe is seen running from the point of its attachment to a small chalaza at the base; its embryo, enveloped in solid albumen, has a small superior radicle and two oblong foliaceous cotyledons, with their face turned to the centre of the fruit. One important part of this structure is the axile column, or, as some would call it, the gynobase, although it is in the form of a spindle-shaped vesicular membranaceous tube, originating at its base in the extremely small torus, and terminating at its summit in continuity with the persistent style, where it also unites with the pericarpial covering of the fruit; it has four distinct longitudinal cords or bundles of spiral threads terminating below the style, some of which adhere to the fungous lines seen upon the nucules; this tube touches the smooth ventral faces of the nuts, without absolutely adhering to them; there is no trace of any basal gynobasic attachment of the nuts, which do not even touch the torus.

It has been already noticed (*suprà*, p. 192) that this structure cannot be reconciled either with the *Heliotropiaceæ* or with *Ehretiaceæ* under the conditions hitherto supposed to exist. The reality of the organization above described is, however, unquestionable, being clearly illustrated by Von Martius in the work referred to, in like manner depicted by Dr. Wight (Icon. 1385) and by Sir Wm. Hooker (Icon. 823). In searching for a parallel structure, we naturally come upon the *Hydrophyllaceæ*, with which *Rhabdia* agrees in having a deeply 5-cleft calyx, a campanular corolla with a 5-lobed border, five equal subexserted stamens affixed near the bottom of the tube of the corolla, 2-lobed anthers, a simple style with a 2-lobed stigma, a superior 1-celled ovary with a parietal placentation, as before explained, and albuminous seeds enclosing an embryo with a superior radicle: but here the analogy ceases; for it differs in its suffruticose virgate growth, the stems crowded with simple, almost sessile leaves, the want of scales in the tube of the corolla, and in the totally different structure of the fruit.

In regard to its real affinity, it is clear that the peculiar placentation just described would remove it far from the *Ehretiaceæ*, under the supposition that the carpical structure of the latter accorded with the rule that has been hitherto understood: but it is quite otherwise; for a more searching examination into the structure of *Ehretia* and its congeners has revealed the fact, which I shall be able to demonstrate, that there is little difference in their placentation from that of *Rhabdia* and *Cortesia*. Consequently *Rhabdia* will still remain a member of this family.

There is, however, a wide distinction between *Ehretiaceæ* and *Borraginaceæ* (*Borrageæ* of De Candolle), the latter of which ought certainly to stand as a family distinct from all the tribes associated with them in the 'Prodromus,' because they differ essentially in the peculiar gynobasic disposition of the carpels. By adopting as a basis of arrangement the various modes of organization of the carpels, the *Hydrophyllaceæ* would still occupy the place assigned to them by De Candolle; but if we transpose the *Polemoniaceæ*, *Convolvulaceæ*, and *Erycibeæ* (all with an inferior radicle) to a more suitable position, a more satisfactory arrangement will be attained. The *Ehretiaceæ* osculate with the *Borragineæ*, and approach the *Heliotropieæ* in their distinct carpels and simple style. Though it may be impossible to express the relative degrees of affinity of these several groups in a lineal series, the following would be a nearer approach to it than any hitherto proposed. Thus we should have—*Cyrtandraceæ*, *Hydrophyllaceæ*, *Ehretiaceæ*, *Borragineæ*, *Heliotropiaceæ*, *Cordiaceæ**, *Hydroleaceæ*, *Erycibeæ*, *Convolvulaceæ*, *Polemoniaceæ*, *Scrophulariaceæ*, &c. In this manner the pentandrous hypogynous *Monopetaleæ* with two or four carpellary ovaries and a superior radicle all fall into one continuous series, with more harmonious steps of transition, while those with an inferior radicle are made to follow.

RHABDIA, Mart.;—*Ehretia* in parte auct.—*Sepala* 5, subæqualia, lanceolata, persistentia, æstivatione imbricata. *Corolla* subcampanulata, imo tubulosa, ad medium 5-loba, lobis oblongis, subacutis vel rotundatis. *Stamina* 5, lobis alterna, ad basin tubi inserta; *filamenta* filiformia, tubo longiora; *antheræ* ovatæ, erectæ, 2-lobæ, lobis ovatis, collateraliter adnatis, rima longitudinali introrsum dehiscentibus. *Discus* minimus, glandulosus, simplex aut nullus. *Ovarium* superum, conico-ovatum, semiseptis 2 incompletis e parietibus oppositis protrusis, mox divaricatim bifidis, marginibus singulatim ovulum ambientibus et dein expansis septa 2 parallela incompleta formantibus, hinc pseudo-4-loculare, *ovulis* appensis, *micropyle* supera: *gynobasis* seu columella centralis septis intermedia, tubulosa, vacua, vasis ad ovula pertingentibus munita. *Stylus* filiformis, longitudine staminum. *Stigma* parvum, 2-lobum et subpeltatum. *Drupa* ovato-globosa, nitida, parce succosa, calyce persistente inclusa, 4-pyrena; *pyrenæ* oblongo-ovatæ, dorso convexiores, per paria (medio lineæ placentaris fungosæ) margine semiadhærentes, mox liberæ, subosseæ, uno margine rima longitudinali pro intrusione vasorum oblique fissæ, 1-spermæ: *semen* loculum implens, *hilo* punctiformi conspicuo inter medium et summum appensum; *integumenta* tenuissima, alba, opaca, *raphe* ab hilo ad *chalazam* parvam basalem percursa; *embryo* intra *albumen* carnosum orthotropus, *cotyledonibus* foliaceis, ovatis, faciebus diametro

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* In this interval should be placed a new family, the *Auxemmaceæ*, which will be shortly described.

fructus parallelis, *radicula* tereti ad summum spectante 2–3-plo longioribus.

Suffrutices *Brasilienses et Asiatici:* caules *plurimi*, *congesti*, *erecti*, *virgati*, *subramosi*, ramis *adscendentibus;* folia *plurima*, *alterna*, *lineari-oblonga*, *sessilia*, *aut brevissime petiolata*, *subpuberula;* racemi *in ramulis novellis terminales*, *pauciflori;* flores *parvi*, *breviter pedicellati*, pedicellis *medio bracteatis.*

1. *Rhabdia lycioides*, Mart. Nov. Gen. ii. 136, tab. 195; DC. Prodr. ix. 512; Fresen. in Mart. Fl. Bras. xix. p. 58, tab. 9. fig. 9;—caulibus plurimis, congestis, erectis, ramosis; ramis adscendentibus, virgatis, elongatis, breviter ramulosis; ramulis apice floriferis; foliis sparsis, sursum gradatim minoribus, lineari-oblongis, apice obtusis aut breviter acutis, imum versus latioribus et rotundato-truncatis, marginibus undulatis, sessilibus, erecto-patulis, utrinque pubescenti-hirtis, pilis (præsertim subtus) imo tuberculatis, subtus pallide viridibus, costa prominente viridi-rubescente pubescenti-hirtula: racemis in ramulis novellis terminalibus, brevissimis, simplicibus vel 2-fidis, 2–3-floris, pedicellisque imo bracteatis et calycibus molliter pilosis; floribus imo bracteolatis; bacca globoso-ovata, nitida, coccinea. — In Brasilia prov. Bahia, Rio S. Francisco, in inundatis prope Joazeiro. (*Non vidi.*)

Martius describes this species as growing in numerous cæspitose upright branches, 5 or 6 feet high; these throw out several erect branchlets, which are again ramified: the leaves are alternate, 4–6 or 8 lines apart, 1–1½ inch long, 4–5 lines broad; the bracts are 1½ line long; the sepals 1½–2 lines long; the corolla 2½ lines long, the tubular part being white, the lobes of a dark rose-colour; the ovary, seated on a small fleshy disk, is 1 line, the style 2 lines long; the crimson berry encloses four small nuts imbedded in a small quantity of pulp. It was found in flower and fruit in the months of March and April. Its vernacular name is *Apicum.*

2. *Rhabdia crebrifolia*, n. sp.;—ramis teretibus, nudis, fuscis, glabris; ramulis brevibus, imbricatim foliosis, novellis puberulis; foliis lineari-oblongis, a medio ad basin sensim angustatis, superne subacutis, cum acumine brevissimo canaliculatim reflexo, integris, utraque facie opacis, pallide concoloribus et pilis simplicibus molliter puberulis, crassis, fere enerviis, costa subtus prominula, primum erectis, dein subreflexis, petiolo tereti, puberulo, limbo 15-plo breviore: racemulis in ramulis novellis terminalibus, brevibus, intra

folia dense imbricata fere absconditis, alternatim 4–5-floris; pedicellis brevibus, imo bractea majore, medio bracteola lanceolata pilosa donatis; calyce ebractcato, profunde 5-partito, lobis oblongis, acuminatis; bacca subglobosa, nitente, calyce persistente inclusa.—In Brasilia: *v. s. in herb. Mus. Brit. et Hook.*, prov. Ceará (Gardner, 1793).

This plant, somewhat resembling the preceding, was found by Gardner on the sandy banks of the Rio Salgado, near the town of Icó, in August 1838. It differs in its closer, more imbricated, smaller leaves, narrowed at the base, upon a very short petiole, and not sinuated on the margin. The branches are generally of no great length; but the flowering branchlets, seldom more than 1½ inch long, and 4–6 lines apart, are thickly covered with imbricated leaves, and bear a single raceme almost hidden at their extremity; the leaves are 6–8 lines long, 2½ lines broad, narrowing gradually towards the base into an extremely short petiole; the raceme is 4–8 lines long, with four or five alternate flowers, upon pedicels ½–1 line long; the basal bract is 3 or 4 lines, the median one 2 lines long; the calyx is shortly campanular at its base, and cleft into five equal erect segments somewhat imbricated in æstivation, broader in the middle than at the base, and very acute, 2 lines long, smooth inside, covered outside with short soft hairs emanating from minute tubercles, and with ciliated margins; the corolla is very deciduous, its tube 1 line long, its border somewhat campanulate and reflected, has five lobes 2½ lines long, ¾ line broad; the filaments, glabrous, fixed near the base of the tube, are 2 lines long; the anthers subglobose and didymous; there is no disk, but the subglobose ovary is shortly stipitated; the style is compressed, 2-grooved, the length of the stamens, and persistent; the flat peltate stigma is 2-lobed, the drupe, subglobose, 4-grooved, slightly compressed, is 1 line in diameter, with a polished submembranaceous lax pericarp, apparently filled with mucilaginous juice which disappears in drying, enclosing four nucules, as before explained, attached to a membranaceous ventricose central column.*

3. *Rhabdia viminea*, Dalz. in Hook. Icon. tab. 823;—Ehretia (Xerodema) viminea, *Wall. Cat.* 906; *DC. Prodr.* ix. 569; —Ehretia cuneata, *Wight*, *Icon.* iv. tab. 1385;—ramosa, ramis teretibus, vimineis, adpresse setosis; foliis alternis, copiosis, cuneato-oblongis, apice rotundatis et brevissime mucronatis, supra glabris, subtus adpresse setosis; petiolo limbo 10-plo breviore: racemis in ramulis novellis termi-

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* A representation of this species, with ample structural details, is given in Plate 84.

nalibus, brevissimis, 2–3-floris; pedicellis brevibus, imo bracteatis; sepalis lanceolatis, pilosis; corolla breviter tubulosa, limbi lobis oblongis, apice rotundatis, campanulatim expansis; antheris lineari-oblongis, exsertis; drupa parva, pallida.—In India orientali, provv. Martaban, Madras, et Malabar.

This, according to Dr. Wight, is a small, very branching shrub, growing on the sandy banks of rivers, like the two preceding species. The drawings of Wight and Hooker quite agree in all points of structure with the figures given by Martius of the typical species. The axils are 2–3 lines apart; the leaves are 8–10 lines long, 3–3½ lines broad, on a petiole ½ line long; the flowering branchlets are ½–¾ inch long; the sepals are lanceolate, canaliculate at the apex, 3 lines long; there is no disk; the form and structure of the ovary, style, fruit, and albuminous seeds as in the typical species.

ON THE EHRETIACEÆ.

EHRETIA.

This genus, as arranged by DeCandolle, is very heterogeneous, and requires redistribution, as it contains several distinct groups easily recognized by good characters, especially by those founded on their carpical structure. After the examination of all the plants within my reach, referred to *Ehretia*, from the New World, I propose to retain in the genus only those species which are proximate to *E. tinifolia*, Linn. Many of those belonging to the Old World will probably be found, upon critical examination, to be foreign to the genus. I have not had leisure to analyse them; but among those which I have examined, some distinct forms have been noticed. A few from Australia and Asia have a fruit containing four nucules, each 2-celled and 2-seeded, with a particular organization; others, again, have a bifid style, each obcuneiform branch bearing two distinct sessile stigmata; but the placentation of the ovary is that of *Ehretia* and *Rhabdia*.

The greater number of the Neogean species of *Ehretia* enumerated by DeCandolle enter into the genera *Bourreria* and *Crematomia*: these are distinguishable at a glance from *Ehretia* by their much larger, tubular, fleshy calyx, terminated by five teeth with thick tomentous margins, which are valvately closed in æstivation, and afterwards sometimes adhere so strongly together as to be separable with difficulty.

The *Ehretia spinosa* of Jacquin, judging from the characters he assigned to it, appears to differ in no way from *Rhabdia*, except in the pointed extremities of its deeply bipartite style: this plant constituted the second species of Don's unrecognized and incongruous genus *Lutrostylis*, the type of which, the *Ehretia fasciculata* of Kunth, is of very different structure, and will presently be noticed; his third species was the *Ehretia Montevidensis* of Sprengel, which, from Sellow's original specimen in the Berlin Herbarium, has proved to be the *Citharexylon barbinerve* of Chamisso.

It has already been mentioned that there exists in the organization of the ovary and fruit of the *Ehretiaceæ* a point of structure which has escaped general observation: this is, the placentation of the ovary, and the existence of a gynobasic or central column which furnishes the nutrient vessels for the growth of the ovules; the course of these vessels may always be traced through apertures existing in the nucules where they terminate in the funicular points of suspension of the seeds. Hence the frequent geminate connexion of the distinct nucules in pairs in this family, a connexion effected either through a chink on one side only of each cell, sometimes near the summit (as I have already shown in *Rhabdia*, *suprà*, p. 219), or sometimes, through the intermedium of a pseudo-cell, from a large opening above the base, as is seen in *Bourreria*: these modifications furnish good characters, which mark the different genera of the *Ehretiaceæ*, and which serve at once to distinguish this family from the *Cordiaceæ*, *Heliotropiaceæ*, and *Borraginaceæ*.

The following is a reformed diagnosis of the genus under consideration:—

EHRETIA, Linn.—*Calyx* parvus, persistens, subcampanulatus, imo crassiusculus, fere ad basin 5-partitus, laciniis subovatis aut subulatis, margine membranaceis et ciliatis, æstivatione imbricatis. *Corolla* gamopetala, hypogyna, membranacea, tubo sæpius calycis longitudine aut paulo longiore, limbi lobis 5, oblongis, tubo paulo longioribus, revolutim expansis, æstivatione valde imbricatis. *Stamina* 5, alterna; *filamenta* compressa, subulato-filiformia, tubo affixa, exserta; *antheræ* ovatæ, 2-lobæ, imo ad medium divaricatæ, locellis sine connectivo adnatis, membranaceis, rima longitudinali lateraliter dehiscentibus. *Ovarium* conico-oblongum, *disco* parvo insitum; primum 1-loculare, *semiseptis* 2, parietalibus, oppositis, in crura magna utrinque bilamellatim reflexis, ovulis accedentibus et deinde dissepimenta 2 parallela efformantibus, cum interspatio pro columella distincto; *columella* cen-

tralis, transversim compressa, sublibera, lamellis parallela, axi vacua, vasa nutritoria intra locellos emittens; inde 4-loculare, 4-ovulata, *ovulis* summum versus appensis. *Stylus* erectus, exsertus, apice breviter aut minime bifidus, *stigmatibus* 2 parvulis subclavatis terminatus. *Drupa* globosa, subcarnosa, calyce persistente circumdata, 2-pyrena, *pyrenis* 2-locularibus, osseis, extus convexis, intus concavis, hinc sub apice lateribus *foramine* parvo loculum ingrediente utrinque perforatis, *loculis* 1-spermis. *Semen* teres, in quoque loculo e foramine appensum; *integumenta* tenuissima, papyracea; *embryo* in albumine parco rectus, teres, *radicula* supera.

Arbusculæ (*rarius* arbores) *Neogeæ, plerumque Mexicanæ;* folia *alterna, oblonga, integra vel serrata, glabra aut tuberculato-scabrida, petiolata:* paniculæ *corymbosæ, multiramosæ, terminales:* flores *parvi, albidi.*

1. *Ehretia tinifolia*, Linn. Amœn. v. 595, Syst. 192, p. 906, i. 309; Jacq. Amer. 45; Sw. Obs. 87; Willd. Sp. i. 1077; DeCand. Prodr. ix. 503;—Ehretia arborea, *P. Br. Jam.* 168, tab. 16. fig. 1;—Ceraso affinis (*in parte*), *Sloane, Jam.* ii. 94 (*nec icone ibi referta*);—ramulis tenuibus, teretibus, glabris; foliis ovato-ellipticis aut oblongis, utrinque sensim angustatis, subacutis, aut obtusule acuminatis, imo obtusis, planis, glaberrimis, supra subnitidis, planis, reticulatim nervosis, submembranaceis aut crassioribus, subtus pallidioribus, nervis tenuibus paulo prominulis, in ramis infimis multo majoribus et semper planis; petiolo subtenui, sulcato, glabro, limbo 14-plo breviore: panicula terminali, ramosa, multidivisa, ramulis tenerrimis, compressis, glabris, sæpe laxe expansis; floribus parvis, albidis.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (Sloan. hb. vol. vii. fol. 6 cum icone ex vivo, specim. typ.); Jamaica (P. Browne); ib. (Shakespear); Cuba (Linden, 1983); *in herb. Hook.*, Cuba (Wright, 1360, 1366).

All botanists have referred to Sloane as the earliest authority for this species, and the typical plant in his herbarium confirms this; but they have all overlooked the fact that Sloane collected two species, which are still preserved, one in fol. 5, the other in fol. 6, of his herbarium: the latter is accompanied by his own coloured drawing, taken "ex vivo," in fruit; but the plant corresponding with it is in flower. When Sloane published his work, he gave a figure in pl. 203. fig. 1, which is an exact tracing from his first specimen; but he added to it the fructiferous raceme, copied from his drawing, which does not exist in the specimen. It is evident, however, that his description in vol. ii. p. 94 does not refer to the first,

but to the second specimen, with cerasiform leaves, and named by him "*Ceraso affinis*;" for the dimensions he gives of the leaves of this "*Bastard Cherry*" are 2½ inches long, 1 inch broad, which agree with the second plant, but not at all with the first. P. Browne's description and drawing of this same species, above quoted, conforms in the size and shape of the leaves with Sloane's second plant; and it is manifest that Linnæus's *Ehretia tinifolia* is identical with the same form, as he quotes Browne as his authority. Jacquin and Swartz must have had the same plant in view when they gave more copious characters to the species. We have thus the true *E. tinifolia* identified in an unmistakable manner.

It is described as a tree 16 to 20 feet high, growing commonly in the lowlands of the eastern portion of Jamaica; its leaves are 2½–3½ inches long, 1–1¾ inch broad, on a somewhat slender petiole 2–3 lines long. In Linden's plant the leaves are thin in texture, in Wright's they are thicker in substance. The terminal panicle is 1½–2 inches long.

2. *Ehretia sulcata*, nob.;—Ceraso affinis, *Sloane* (*in parte*), *Jam.* ii. tab. 203. fig. 1 (*non descript.*); Trew, Ehr. t. 25;—ramulis crassioribus, teretibus, striatis, rubescentibus, glabris; foliis oblongis aut ovato-oblongis, apice sensim angustioribus, obtusule acuminatis vel obtusis, canaliculatim recurvulis, imo rotundiusculis aut valde obtusis, in petiolo brevissime decurrentibus, ubique glaberrimis, coriaceis, supra pallide viridibus, ad costam latam nervosque rubellos flavidosve sulcatis, in vetustioribus valleculatis, interspatiis tunc plus minusve convexis, marginibus integris vix revolutis, subtus concoloribus, nervis prominentibus; petiolo lato, crassiusculo, supra valde sulcato, glabro, limbo 12-plo breviore: panicula corymbosa, terminali, ramosissima, ramis tenuibus, compressis, glabris.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (in hb. Sloan. vol. vii. fol. 5); *in hort. Kew. cult.*; Jamaica (Houston); *in herb. Hook.*, Jamaica (Purdie), Cuba (La Sagra), ib. Havana (Greene).

In describing the preceding species, I have explained how this has been confounded with it. Its leaves are much larger, more coriaceous, broader, more rounded at base, have a much broader and reddish midrib, more distant and much more divaricated nerves seated in hollow furrows, often leaving the spaces between them very convex; the petiole is much broader, thicker, and more deeply channelled. The leaves are 3¼–5½ inches long, 1¾–3½ inches broad, on a petiole 4–5 lines long. Trew figures separately a leaf from the older lower branches, which is 8 inches long and 4¼ inches broad.

It is a tree 20–30 feet high, growing in the more westerly portions of the island of Jamaica.

3. *Ehretia longifolia*, nob.;—ramulis tenuibus, angulato-striatis, pulverulento-glaucis; foliis elongato-oblongis, sublanceolatis, lateribus in medio parallele rectis, dehinc utrinque attenuatis, cum acumine obtusulo, imo in petiolo decurrentibus, integris, supra glabris, subnitidis, læte viridibus, nervis tenuissimis, divaricatis, arcuatim nexis, subimmersis, reticulatis, subtus fere concoloribus, sub lente minute scabridulis, nervis venisque prominulis, marginibus vix revolutis; petiolo semitereti, subglabro, limbo 20-plo breviore: paniculis terminalibus, racemosis, folio paulo brevioribus; ramis imo nudiusculis, bracteolatis, alternatim multidivisis, ramulis tenuibus, compressis, glaucis vel minute strigoso-puberulis; floribus parvis, albis, suaveolentibus.—In Antillis et Mexico: *v. s. in herb. Hook.*, Jamaica (Lane); ib. (Macfadyen); Oaxaca (Galeotti, 7194).

A very distinct species: it forms a handsome tree, with leaves 5–6 inches long, 1¾–2½ inches broad, on a petiole 3 lines long.

4. *Ehretia elliptica*, DC. Prod. ix. 503;—ramis teretibus, glabris, lenticellatis, ramulis hirtellis; foliis ellipticis, utrinque obtusis, apice paulo angustioribus et calloso-mucronatis, integris, in junioribus submembranaceis, supra nitentibus, planis, minute tuberculatis et scabrido-pilosis, in vetustioribus rigide coriaceis, fuscis, tuberculis nunc valde auctis et subconfluentibus, creberrime albo-rugosis, asperrimis, convexiusculis et in nervis valde sulcatis, marginibus subrevolutis, subtus brunneis, opacis, subglabris aut obsolete scabris, nervis prominentibus, scabridulis, in axillis barbatis; petiolo canaliculato, scabrido-piloso, limbo 12-plo breviore: paniculis racemosis, terminalibus, ramosis, scabrido-pilosis; floribus breviter pedicellatis; calyce ad basin 5-partito, rigide piloso, lobis acutissimis, erectis; corollæ tubo ante stamina intus plicato laciniisque oblongis reflexis calycem æquantibus; filamentis subulatis, medio tubi ad plicaturas geniculatim insertis, longe exsertis; stylo his æquilongo, apice bifido, stigmatibus parvis, obtusis; drupa pisiformi, nuculis 2 generis structura.—In Mexico: *v. s. in herb. Mus. Brit.*, Rio Grande (Berlandier, 2330); *in herb. Hook.*, Matamoras (Berlandier, 939, 2369 in flore, 2320 in fructu, 900 in flore et fruct.).

A very rough-looking plant, with cano-scabrid approximated leaves, 1½–2½ inches long, ⅞–1¼ inch broad, on a petiole 1½–2

lines long. The panicle is little more than an inch long; the calyx is 1¼ line long; the tube of the corolla is 1½, the lobes 1¾ line long; the drupe is 2 lines in diameter, enveloped by the calyx; the style is cleft for one-sixth of its length*.

5. *Ehretia scabra*, Kth. et Bou. in Walp. Ann. i. p. 524;—ramulis teretibus, hispidulo-scabris; foliis oblongis, mucronato-acutis, imo in petiolo decurrentibus, integris, supra scabris, subtus glabris, petiolo limbo 12-plo breviore: corymbis terminalibus, subdichotomis, scabro-hispidulis; calyce 5-partito, laciniis lanceolato-subulatis, hispidulis; corollæ lobis patentibus, staminibus exsertis; stylo apice bifido.—E Mexico? (*non vidi*).

This description is given by Kunth of a plant cultivated in Berlin, supposed to be of Mexican origin: it is very near the preceding species, apparently differing only in the shape and size of its leaves, which are 4–4½ inches long, 19–20 lines broad, on a petiole 4 lines long.

6. *Ehretia ciliata*, nob.;—ramis nudiusculis, nitidis, lenticellatis, subcompressis, ramulis ultimis brevibus, divaricatis, foliiferis; foliis ellipticis, imo obtusis, apice subacutis, mucronatis, integris, planis, supra pallide viridibus, opacis, utrinque scabridule pilosis, nervis immersis, subtus paulo pallidioribus, in axillis nervorum subbarbatis; petiolo tenui, piloso, limbo 10-plo breviore: corymbis in ramulis ultimis terminalibus, folio longioribus, pilosulis, alternatim pluriramosis; floribus subapproximatis, pedicellatis; calyce profunde 5-partito, laciniis acutissimis, erectis, extus aspero-pilosis, intus pilosulis; corollæ lobis oblongis, tuboque calyci æquilongis; staminibus medio tubi insertis, exsertis; stylo breviter bifido, ramis crassiusculis.—In Texas: *v. s. in herb. Hook.* (Lindheimer, 665).

In this species the leaves are 1⅝–1¾ inch long, 7–9 lines broad, on a petiole 2 lines long: the panicle is about 7 inches long; the calyx, tube, and lobes of the border are each 2 lines long.

7. *Ehretia latifolia*, DC. Prodr. ix. 503;—ramis tenuibus, subteretibus, rugoso-lenticellatis, striatis, glabris; ramulis subcompressis, subpubescentibus; foliis late ovatis, imo subrotundis et circa petiolum breviter subito attenuatis, apice brevissime et obtusule apiculatis, planis, margine serratis aut serrulatis, dentibus mucronulatis, submembranaceis, supra subnitidis, læte viridibus, tenuiter nervosis, e tuberculis mi-

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* A drawing of this species, with analytical details, is shown in Plate 85.

nimis sparsis adpresse scabridulo-pilosis, subtus pallidioribus, subglabris aut in nervis venisque transversis prominulis tantum pilosulis, reticulatis, in axillis nervorum paulo barbatis; petiolo subtereti, subtenui, fere glabro, limbo 6-plo breviore: panicula corymbosa, terminali, folio dimidio breviore, ramis divaricatis, scabrido-hirtellis; calyce profunde 5-partito, extus ruguloso, intusque glabro, lobis oblongis, obtusis, margine ciliatis; corollæ lobis oblongis, rotundatis, tuboque calyci æquilongis; staminibus medio tubi insertis, longe exsertis; stylo apice breviter bifido; ovario drupaque pisiformi structura generis.—In Mexico: *v. s. in herb. Hook.*, Sangolica (Broteri, 1022); Oaxaca (Galeotti, 3099).

A very distinct species, with leaves 3–4½ inches long, 1½–3 inches broad, on a petiole 6–9 lines long; the calyx is 1 line long, the tube and lobes each of the same length.

8 *Ehretia exasperata*, nob.;—ramulis teretibus, rugoso-lenticellatis, junioribus scabridis; foliis oblongis, utrinque sensim obtusis, a medio ad basin paulo angustioribus, marginibus remotiuscule sinuatis aut irregulariter grosse crenatis, fragiliter coriaceis, supra viridibus, subnitentibus, tuberculis albis piligeris crebre asperatis, in nervis longe intra marginem arcuatim nexis sulcatis, subtus pallidioribus, rigide scabridis, nervis prominentibus, in axillis barbatis; petiolo latiusculo, sulcato, hispido-pilosulo, limbo 18-plo breviore: paniculis terminalibus, divaricato-ramosis, rigidule hirsutulis; calyce ad basin 5-partito, laciniis oblongis, acuminatis, scabride hirsutulis; drupa 2-pyrena.—In Texas: *v. s. in herb. Hook.*, San Felipe (Drummond, 296).

A species approaching *E. elliptica*, but very distinct from it. The axils are about ¾ inch apart; the leaves are 3–3½ inches long, 1¾–2 inches broad, on a petiole 2 lines long; the panicle is 2½ inches long, the calyx 1¼ line long, the drupe 2¼ lines in diameter.

BOURRERIA.

I have already stated (*suprà*, p. 224) that the *Bourreria* of Browne (*Beurreria*, Jacq.), which DeCandolle regarded as a mere section of *Ehretia*, must be regarded as a distinct genus, on account of the several differential characters there mentioned. Its drupaceous fruit encloses four nucules, flattened on their converging angular sides, rounded exteriorly, where they are cleft obliquely into many thin laminiform plates, which are intersected by small divisions into numerous cells filled with fibrous and pulpy matter, thus forming a sub-

spongiose rigid network on the exterior side; its inner portion is osseous, angular, and contains a single seed: this seminiferous cell is somewhat incurved longitudinally round another spurious cell, with which it has a placentary communication through a small spot to which the single seed is attached by its middle: this spurious cell is filled with nourishing tissue, and has a large foramen opening externally on one side of the nucule, either on the right or left side; for the four nuts are geminately arranged in pairs, as in *Rhabdia*, and in each pair, upon their contiguous sides, these foraminal openings face one another, while the opposite sides are plane; and through these channels the nourishing vessels from the placentary column are seen to enter each cell: the seed, which fills the true cell, is cylindrical, somewhat incurved as before mentioned, and attached by its middle to the placentary point; upon the integument on that side a line of descending raphe runs from the hilum to a small basal chalaza. Although Gaertner, by mistake, reversed its position, he was quite correct in stating that the embryo is enclosed in a rather thick fleshy albumen, notwithstanding that Prof. A. De Candolle mentions that he had been unable to find it. The calyx and corolla resemble those of *Crematomia*, only that the lobes of the border in *Bourreria* are simple, not auriculated; the style is more shortly bifid; the ovary has the placentation of *Rhabdia*.

BOURRERIA, Browne;—Beurreria, *Jacq.*;—Ehretiæ sect., DC. —*Calyx* ad medium tubulosus, coriaceus, superne in lobos 5 (rarius 6) acutos divisus, marginibus crassis, tomentosis, æstivatione valvatis, firme adhærentibus, demum solutis, vel interdum false 2–3-lobus, persistens. *Corolla* gamopetala, tubo calyce paulo longiore, limbi laciniis 5 (rarius 6), oblongis vel rotundatis, patentibus, tubo paulo longioribus, æstivatione valde imbricatis. *Stamina* 5 (raro 6), alterna, longiuscule exserta aut vix exclusa; *filamenta* subulata, carnosula, medio tubi vel sub faucem affixa, sæpe cum costis totidem decurrentibus continua; *antheræ* oblongæ, 2-lobæ, lobis coriaceis, sæpe rugulosis, imo a medio divergentibus, superne collateraliter adnatis, utrinque rima longitudinali nivea lateraliter dehiscentibus, sinu dorsali ad filamentum breviter curvatum versatiliter affixæ: *pollen* globosum, tela tartarea intermixtum. *Ovarium* oblongum, striatum, *disco* parvo suffultum, semiseptis e parietibus 2 oppositis intergerivis, mox in crura magna utrinque divaricatim recurvis, septa 2 parallela subincompleta efformantibus, marginibus *ovulum* singulatim amplectentibus, hinc pseudo-4-loculare, 4-ovulatum: *columella* compressa, membranacea, septis parallela,

in axi sistens et fibros nutritorios intra loculos emittens. *Stylus* teres, longiuscule exsertus, apice breviter bi- (rarius tri-)fidus, ramis *stigmate* peltato singulatim clavatis. *Drupa* carnosa, globosa, 4-pyrena; *pyrena* intus angulata, extus convexa, bigeminatim per paria materiei placentari laxe adhærentes, dorso oblique spongioso-cellulosa et reticulato-favosa, aliter ossea, 1-loculares, singulatim latere unico (invicem dextro et sinistro) locello spurio infossata, *loculo* vero circum spurium paulo curvato, 1-spermo. *Semen* loculum implens, cylindricum, teres, paulo curvatum, juxta locellum spurium puncto medio appensum: *integumenta* tenuia, *raphe* lineari ab hilo ad *chalazam* basalem descendente notata: *embryo* in *albumini* subamplo carnoso semianatropus et paulo curvatus, *radicula* tereti, supera, *cotyledonibus* æquilatis subcompressis hilo parallelis æquilonga.

Arbores et arbusculæ *ramosi, in America intertropicali et in Antillis indigeni;* folia *alterna, oblonga vel obovata, integra, petiolata:* paniculæ *corymbosæ, terminales, dichotome ramosæ;* flores *mediocres, albidi:* drupæ *aurantiacæ vel rubræ, nitidæ.*

1. *Bourreria* (*Beurreria*) *succulenta*, Jacq. Amer. 44; Obs. 2, tab. 26; Gaertn. iii. 170, tab. 212 (non Griseb.);—Bourreria arborea, *Browne*, *Jam.* 168, tab. 15. fig. 2; Ehretia Bourreria, *Linn. Syst.* iii. 936; *Lam. Dict.* i. 527; DC. Prodr. ix. 506;—Cordia Bourreria, *Linn. Amœn.* v. 395;—Jasminum periclymenifolium, *Sloane*, *Jam.* ii. 96, tab. 204. fig. 1; *Ray*, *Dendr.* 63;—ramulis teretibus, subangulatis, tenuibus, glabris; foliis obovato-oblongis aut ovatis, imo cuneatis, apice rotundatis vel obtusis, glabris, supra nitidis, ad nervos sulcatis, subtus pallidioribus, flavidiusculis, nervis paulo prominulis, margine subundulatis; petiolo canaliculato, limbo 8–10-plo breviore: racemis apud ramulos ultimos novellos paucifoliosos terminalibus, brevibus, foliis delapsis deinde corymbum laxiusculum mentientibus, brachiis compressis, glabris; calyce tubuloso, crasso, glaberrimo, acute semi-5-fido, dentibus margine tomentosis; corollæ tubo calyce paulo longiore, limbi lobis oblongis, expansis; staminibus paulo exsertis; drupa globosa, carnosa, crocea, piso majore, 4-pyrena.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (specim. typ. in hb. Sloan. vol. vii. fol. 36, planta superior); Jamaica (Dr. Wright).

Many plants have been confounded with this species, the type of which exists in Sloane's herbarium; and, as no doubt can be raised concerning it, I have reformed its specific character from the original. It is described by Sloane and Browne

as a tree from 14 to 20 feet high, growing in the lowlands of Jamaica. The leaves are 2½ inches long, 1½ inch broad, on a petiole 3–4 lines long; the racemes, terminal on the young branches, seldom exceed an inch in length; but as the leaves fall off, the inflorescence assumes the appearance of a more extended irregular corymb; the flowers are white, upon very short pedicels; the calyx is fleshy, 3 lines long, glabrous outside, pubescent within the teeth, which are tomentose on the margins; the tube of the corolla is 5 lines long, the lobes of the border 3 lines long; the subulate filaments are inserted above the base of the tube and extend beyond its mouth, the anthers are versatile, attached in the sinus of their divergent base. The placentation of the ovary and the structure of the fruit accord with the above generic character; the drupes, of a saffron-colour, are 3 lines in diameter.

The plant described by Desfontaines under the name of *Ehretia Bourreria* corresponds with my *B. recurva*, agreeing in the size and shape of its leaves, its inflorescence, and the peculiar form of the style. Jacquin's description embraces more than one species. The *Bourreria succulenta*, Grisebach (non Jacq.), Cat. Pl. Cub. p. 209, refers to two very different plants (both, Wright, 3119), described by him as flowering and fructiferous examples of this species: the former is a species closely allied to *Patagonula*, the latter is my *Bourreria clariuscula*.

2. *Bourreria Domingensis*, nob. (non Griseb.);—Ehretia Domingensis, *DC. Prodr.* ix. 508;—ramulis subangularibus, striatis, glabris; foliis oblongis aut oblongo-ellipticis, imo obtuse angustioribus, apice subacutis vel repente obtuse acuminatis, planis vel paulo navicularibus, supra nitidis, nervis tenuibus immersis, reticulatis, utrinque glaberrimis (nisi costa mediana superne sulcata et pilosula), subtus fulvo-glaucis, costa nervisque nitidis, rubescentibus, prominulis, in nervo marginali vix revolutis; petiolo tenui, supra canaliculato, glabro, rubello, margine ciliato, limbo 9-plo breviore: panicula corymbosa, terminali, laxe repetitim ramosa, ramis bracteatis, ramulisque angulato-compressis, glabris; floribus brevissime pedicellatis; calyce extus glabro, ad medium 5-fido, dentibus acutis, intus pubescentibus; corollæ tubo calyce vix longiore, laciniis ovatis, extus tomentellis, patentibus; filamentis tenuibus, sub faucem enatis, cum costis totidem tubo decurrentibus continuis, exsertis; ovario disco insito, conico-oblongo, striato; stylo tereti, apice breviter bifido; drupa globosa, 4-pyrena.—In Antillis: *v. s. in herb. Mus. Brit.*, in ins. Carib. (Ryan),

(De Pouthieu); *in herb. Hook.*, St. Vincent (Guilding), Domenico (Imray, 127), Antigua (Nicholson).

The *Bourreria Domingensis* of Dr. Grisebach (Fl. Br. W. Ind. p. 482) is evidently a very different species, judging from his short character, in having a cyme terminated with glomerated sericeous flowers, a hoary calyx; and from his description of the leaves it appears to me to be my *Crematomia attenuata*; this is confirmed by his citing as an example Dr. Alexander's plant from Albion Pen, in Jamaica, which I have elsewhere described.

The leaves in this species are 3–4½ inches long, 1¼–1⅝ inch broad, on a petiole 4–6 (rarely 7) lines long. The panicles, terminal upon the younger ultimate branchlets, are about 2 inches long; and several of these often combine to make a large spreading corymb 5 inches long and broad; the calyx is 3 lines, the tube of the corolla 4 lines long, its lobes 3 lines in diameter; the ovary and fruit in their construction conform with the generic character.

3. *Bourreria recurva*, nob.;—Ehretia Bourreria, *Desf.* (*non Linn.*) *Ann. Mus.* i. 279:—ramulis compressis, glabris; foliis late ovatis, naviculari-recurvis et canaliculatis, apice brevi obtusulo attenuatis, imo rotundatis, inæquilateris et in petiolum subito brevissime decurrentibus, utrinque glaberrimis, supra subnitidis, reticulatis, subtus paulo pallidioribus; petiolo canaliculato, glabro, limbo 10-plo breviore: panicula terminali, a basi dichotoma, laxe et late expansa, ramis compressis, glabris; calyce carnoso, acute 5-dentato, fusco, extus glabro, intus pallido et subpuberulo; corollæ tubo calyce paulo longiore, lobis rotundatis; staminibus medio tubi insertis, cum costis totidem tubo adnatis continuis, exsertis; stylo exserto, superne incrassato, valde dilatato, 2-sulcato, emarginato, indiviso, stigmatibus 2 distinctis sessilibus terminato.—In Antillis: *v. s. in herb. Hook.*, Prince Rupert's Head, ins. Domenico.

A species differing from the two preceding in the very deeply channelled recurved leaves rounded at base, in its inflorescence, and particularly in the agglutinated divisions of the style. The axils are ¾–1 inch apart, the leaves 3¼–4 inches long, 1¾–2½ inches broad, on a slender petiole 4–5 lines long. The spreading panicle is 3 inches long, 5 inches broad; the calyx is 3 lines long, the tube of the corolla 4 lines, the lobes 2 lines in diameter.

4. *Bourreria ovata*, nob.;—ramulis teretibus, violaceis, cinereo-glaucis, glabris; foliis rotundato-ovatis aut oblongo-ovatis,

apice suborbiculatis, imo breviter acutis aut obtusis, sæpe inæquilateris, planis, utrinque glaberrimis et valde opacis, nervis tenuibus venisque reticulatis subimmersis, fusco-viridibus, subtus paulo pallidioribus, nervis vix prominulis, nitentibus; petiolo tenuissimo, canaliculato, recto, limbo 4-plo breviore: panicula corymbosa, terminali, dichotome divisa, ramis interdum 1-foliolosis, ramulisque tenuibus, compressis, glabris; floribus brevissime pedicellatis; calyce obconico, crassiusculo, glabro, dentibus intus velutinis; corollæ tubo calyce paulo longiore, crassiusculo, lobis rotundato-oblongis, paulo brevioribus; staminibus medio tubi insertis, paulo exsertis; stylo breviter bifido.—In Antillis: *v. s. in herb. Mus. Brit.*, Bahamas (ex hort. Cliff.); *in herb. Hook.*, Bahamas (anon.), Jamaica (Wilson).

The axils are ½–1 inch apart; the leaves are 2–2¾ inches long, 1¼–1⅝ inch broad, on a stiff slender petiole 6–9 lines long. The terminal panicle is 3 inches long, much divided; the pedicels are ½ line long, the calyx 3 lines, the tube of the corolla 4 lines, the lobes 3 lines long; the anther-cases are rugose and subcoriaceous.

5. *Bourreria clariuscula*, nob.;—Bourreria succulenta, *Griseb.* (*non Jacq.*), *Flor. Cub.* 209;—ramulis subangulatis, subnitidis, glabris; foliis late ovatis, apice rotundatis, brevissime acuminatis vel emarginatis, imo petiolum versus obtusato-attenuatis, subinæquilateris, coriaceis, glaberrimis, supra læte viridibus, nitidis, valde reticulatis, subtus pallidioribus, nervis divaricatis, arcuatim nexis, glaucis, prominentibus; petiolo canaliculato, glabro, limbo 8-plo breviore: paniculis in ramulis alaribus terminalibus, dichotome ramosis, ramis compressis, glabris, paucifloris; calyce coriaceo, glabro, 5-dentato, inæqualiter rupto; corollæ tubo calyce æquilongo, lobos oblongos æquante; drupa piso majore, 4-pyrena; pyrenibus generis.—In Cuba: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3119).

As previously mentioned (*supra*, p. 233), Prof. Grisebach has confounded, under the same name and number of Wright's plants, this and another (a species near *Patagonula*); but neither of them have the smallest resemblance to *Bourreria succulenta* of Jacquin, to which he referred them: the above plant has much broader, far more coriaceous, more reticulated, brighter, and more shining leaves, upon stouter petioles; they are 2–2¾ inches long, 1¾–2¼ inches broad, on a petiole 2–3 lines long; the corymb is 2½ inches long, its peduncle 1½ inch long, the branches 3–6 lines long; the calyx is 3 lines long, the drupe 4 lines in diameter.

6. *Bourreria rigida*, nob.;—ramulis teretibus, pallide glaucis; foliis elongato-ellipticis vel lanceolato-oblongis, apice obtusis aut rotundatis, imo cuneatim attenuatis, coriaceis, marginibus sæpe valde revolutis, supra convexiusculis, viridibus, in nervis sulcatis, fulvidis, minute tuberculato-rugulosis et scabride pilosis, subtus flavido-glaucis, pulverulento-tomentellis, nervis valde prominulis; petiolo rigido, canaliculato, cum costa flavide pulverulento, limbo 7-plo breviore: panicula corymbosa, terminali, dichotome ramosa, tomentella; calyce extus rigide tomentoso, dentibus 5 intus puberulis; corollæ tubo crassiusculo, calyce longiore, lobis rotundato-oblongis; staminibus medio tubi insertis, antheris oscillatoriis, exsertis; stylo apice breviter bi- (rarius tri-)fido. —In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (Houston), ib. (Shakespear); *in herb. Hook.*, Jamaica (Bancroft), ib. (M'Fadyen).

A very distinct species, with branchlets 1½ line in diameter and axils 3–6 lines apart; the leaves are 3–4 inches long, 1¼–1½ inch broad, on a petiole 5–6 lines long: the panicle is about 3 inches long and broad; the calyx 2½ lines long; tube of corolla 3 lines, lobes 2 lines long.

7. *Bourreria virgata*, Don (non Griseb.), Dict. iv. 389;—Ehretia virgata, *Sw. Flor. Ind. Occ.* i. 463; *DC. Prodr.* ix. 506;—fruticosa, ramis tenuissimis, teretibus, flexuosis, divaricatis, ramulis filiformibus, scabridulis; foliis oblongis vel ellipticis, apice obtuse acutis, imo acute attenuatis, supra profunde viridibus, nervis tenuibus immersis, planis, in costa sulcatis, albo-tuberculatis et scabridulo-pilosis, subtus pallidis, in nervis pilosulis; petiolo tereti, scabridulo, limbo 14-plo breviore: paniculis terminalibus, dichotome ramosis, ramis longis, tenuissimis, rigide pilosulis, paucifloris; calyce turbinato, acute 5-dentato, extus pubescente; corollæ tubo calyce duplo longiore, lobis rotundatis, dimidio brevioribus; staminibus imo insertis, antheris fuscis, vix ultra faucem exsertis; stylo apice breviter bifido; drupa (sec. cl. Sw.) subglobosa, 4-costata, nitida, coccinea, 4-pyrena, pyrenibus per paria semiadhærentibus.—In Antillis (ins. S. Domingo in desertis Hispaniolæ, Sw.): *v. s. in herb. Mus. Brit.*, specim. typ. (Swartz, in flore).

A shrub, 7 to 8 feet high, bearing the name of *Guazumillo*, with very slender, almost filiform branches, the axils being about 9 lines apart; the leaves are 1¼–1¾ inch long, 7–10 lines broad, on a petiole 1–1½ line long: the terminal raceme is about 1 inch long, few-flowered, with pedicels 2 lines long;

the calyx is 2¾ lines long, the tube of the corolla 4 lines, its lobes 3 lines long.

The three several plants referred here by Dr. Grisebach (Pl. Wright. Cub. Or. p. 528) all belong to different species.

8. *Bourreria radula*, Don, Dict. iv. 390;—Ehretia radula, *Poir.* (*non Cham.*) *Dict. Suppl.* ii. 2; *DC. Prodr.* ix. 506;—ramulis subangulatis, puberulis; foliis obovatis, apice rotundis vel obtusis, imo cuneatim attenuatis, valde coriaceis, convexis, in costa sulcatis, supra crebre tuberculato-scabris, profunde viridibus, subnitentibus, subtus cinereo- vel fulvido-pallidis, subtomentosis, in nervis prominentibus scabridulis, marginibus valde revolutis; petiolo hispidulo, limbo 12-plo breviore: paniculis terminalibus, laxe corymbosis; calyce tubuloso, cinereo, extus densius, intus sparse adpresso-pilosulis, dentibus obtusis; corollæ tubo calyce paulo longiore; drupa pisi magnitudine, 4-pyrena, pyrenibus structura generis.—In Antillis: S. Domingo (Poiteau): *v. s. in herb. Hook.*, Havana (Greene), Cuba (Drummond), Key West (anon.).

A distinct species, different from the *Bourreria radula* of Chamisso, which is *B. tomentosa.* It is easily distinguished by its small coriaceous leaves, scabrid on both sides, and closely punctulated above with large white raised tubercles. Its leaves are 1–2 inches long, 6–9 lines broad, on a petiole 1–2 lines long.

This species is confounded by Dr. Grisebach (Flor. Br. W. Ind. p. 482) with the *Ehretia Havanensis*, Willd., which he makes a variety of *Bourreria tomentosa.*

9. *Bourreria tomentosa*, Don, Dict. iv. 390;—Ehretia tomentosa, *Lam.* (*non H.B.K.*) *Ill.* i. p. 425. n. 1919; *Poir. Dict. Supp.* ii. 1; *DC. Prodr.* ix. 507;—Ehretia radula, *Cham.* (*non Poir.*) *Linn.* viii. 120;—Jasminum periclymenifolium *in parte*, *Sloane*, *Jam.* ii. 96;—ramis striatis, ramulis brevibus, cinereo- vel brunneo-subvelutinis; foliis oblongis vel ellipticis, apice obtusis vel rotundiusculis, imo obtuse attenuatis, subcoriaceis, supra pallide viridibus, crebre scabridulis, sæpe in nervis tomentellis, subtus pallidioribus, velutino-tomentellis, nervis pubescentibus, marginibus paulo revolutis; petiolo pubescente, limbo 5-plo breviore: paniculis in ramulis terminalibus, brevibus, paucifloris, tomentosis, ramis compressis; calyce 5-dentato, submembranaceo, extus velutino, intus puberulo; corollæ tubo calyce duplo longiore, lobisque ovatis utrinque sparse puberulis; staminibus medio tubi insertis, exsertis; stylo apice bifido; drupa globosa,

piso majore, 4-pyrena, pyrenibus generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Jamaica (in hb. Sloan. vol. vii. folio 36, planta inferior); loc. ignot (Aublet); Cuba (Wright, 3121 in parte); *in herb. Hook.*, Jamaica (March).

Sloane probably regarded this plant as a variety of his typical species, as it is fixed on the same sheet, without any remark. Lamarck, in his 'Illustrations,' established the species upon a plant which he recognized as being similar to it. Poiret quotes Lamarck's type as his authority, confounding it with Sloane's first type: hence the confusion to which DeCandolle alludes. The species is sufficiently distinct. The leaves are 1¼–1¾ inch long, 6–10 lines broad, on a petiole 3–4 lines long. In Aublet's plant they are more scabrid, the hairs rising out of minute white tubercles; the calyx is 2½ lines long, the tube of the corolla 3 lines, the lobes 2½ lines long. Wright's plant above mentioned was considered identical with another under the same number by Dr. Grisebach; the latter is in reality *B. Havanensis*; but he referred both erroneously to *B. virgata*.

10. *Bourreria Havanensis*, nob.;—Ehretia Havanensis, *Willd. in Röm. Sch.* iv. 805; *H.B.K.* vii. 206; *DC. Prodr.* ix. 508; —Bourreria tomentosa, var. Havanensis, *Griseb. Fl. Br. W. Ind.* 482;—Bourreria virgata (*non Don*), *Griseb. in parte Cat. Pl. Cub.* 209;—Pittonia similis, *Catesb. Car.* ii. tab. 79; —fruticosa, ramosissima, ramis sparsis, cinereo-glaucis, glabris, ramulis subpubescentibus; foliis ellipticis aut obovato-oblongis, apice subobtusis aut acutis et mucronatis, sæpe emarginatis, basi sensim attenuatis, subcoriaceis, supra nitidis, reticulate nervosis, vix tuberculatis, glabris, rarius in nervis sparsim adpresse pilosulis, subtus pallidioribus, in nervis venisque pilosulis, planis; petiolo semitereti, subglabro, limbo 6-plo breviore: paniculis corymbosis, sæpius in ramulis novellis terminalibus, subdichotome ramosis, ramulis compressis, pilosulis; floribus brevissime pedicellatis, pedicellis articulatis; calyce coriaceo, cinereo-velutino, acute 5-dentato, dentibus intus puberulis; corollæ tubo calyce fere duplo longiore; lobis orbicularibus extus tomentellis; staminibus medio tubi insertis, exsertis, antheris coriaceis, rugulosis; stylo apice bifido; drupa pisi mole, carnosa, 4-pyrena, pyrenibus generis.—In Antillis; ins. Cuba, Regla prope Havana (Bonpland): *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3121, in parte); *in herb. Hook.*, Habana (La Sagra, sub nom. *E. revoluta*).

The above plants correspond with Kunth's diagnosis, except that the leaves are a trifle larger; in La Sagra's plant they vary from ¾ to 2½ inches long, 7–12 lines broad, on a petiole 2–3 lines long; in Wright's specimen they are paler, more pointed, and more glabrous; the panicle is 1 inch long, with dichotomous branchlets 2–3 lines long; the calyx is 3 lines long, the tube of the corolla 4¼ lines; the drupe 3 lines in diameter*.

11. *Bourreria cassinifolia*, Griseb. Pl. Wright. Cub. 528;—Ehretia cassinifolia, *A. Rich. in La Sagra Fl. Cub.* ii. 113; *Walp. Ann.* v. 541;—ramis sæpius glabris, ramulis vix pilosulis; foliis parvulis, sæpius obovatis, obtusis aut subacutis, imo angustioribus, marginibus apiceque revolutis, crassis, coriaceis, utrinque glaberrimis, supra canaliculatis, nitentibus, nervis immersis, subtus pallidioribus; petiolo glabro, limbo 10-plo breviore: panicula terminali, subdichotome ramosa, pauciflora, sæpius 3–5-flora; calyce minute puberulo, acute 5-dentato, extus subsericeo, dentibus intus puberulis; corollæ tubo calyce paulo longiore, lobis oblongis, rotundatis; staminibus paulo exsertis; stylo brevissime bifido; drupa piso minore, globosa, 4-pyrena, pyrenibus generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3125).

A very distinct species, which is stated by Dr. Grisebach to resemble *B. Domingensis* in many characters; it is difficult, however, to conceive any two plants to be more unlike, the leaves here being at least twenty times as small, with a very different inflorescence. The plant has the appearance of a small *Gaylussacia*, with striated rugulose branches, the younger ones of a reddish hue, with axils 1–4 lines apart; the leaves are only 4–6 lines long, 2½–3 lines broad, on a petiole ½ line long; the panicle is ¾ inch long, sometimes reduced to a solitary flower; the calyx is 2½ lines long, the tube of the corolla 3 lines, its lobes 2 lines long; the drupe is 2 lines in diameter.

12. *Bourreria divaricata*, Don, Dict. iv. 389; Griseb. Pl. Wright. Cub. 528; Cat. Pl. Cub. 210;—Ehretia divaricata, *DC. Cat. Monsp.* 108, *Prodr.* ix. 506;—Ehretia spinifex, *Griseb.* (*non R. & Sch.*) *Pl. Wright. Cub.* 528;—Ehretia montana, *Griseb. loc. cit.* 528;—Ehretia acanthophora, *DC. Prodr.* ix. 510;—fruticosa, ramulis nodosis, cinereis, divaricatissimis; foliis subfasciculatis, spathulato-oblongis, obtusis, subcoriaceis, supra nitentibus, in costa sulcatis, nervis tenuibus, divaricatis, intra marginem arcuatim nexis, albo tuberculatis et aspere scabridis, marginibus valde revolutis, subtus glaucis, pubescentibus, in nervis

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* This species, with analytical details, is shown in Plate 86.

pilosulis; petiolo tomentoso, limbo 10–12-plo breviore: corymbis racemosis, terminalibus, paucifloris; calyce 5-dentato, dealbato, extus sericeo, intus sparse puberulo; corollæ tubo cylindrico, calyce dimidio longiore; staminibus medio tubi insertis, brevibus, vix exsertis; stylo brevissime bifido; drupa globosa, aurantiaca vel rubra, 4-pyrena, pyrenibus generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba, circa Havanam et Monte Verde (Wright, 3136); *in herb. Hook.*, Cuba, Monte Verde (Wright, 1365).

A *Lycium*-like shrub, 2 to 5 feet high, with rigid spreading branches; the leaves are fasciculated in each prominent node, 5–7 lines long, 1½–2 lines broad, tapering into a petiole ½ line long; the terminal raceme is less than 1 inch long, with from four to six alternate flowers on short pedicels; the calyx is 1½ line long, the tube of the corolla 2 lines, the lobes 2 lines long; the drupe is 3 lines in diameter.

This plant is strangely complicated by Dr. Grisebach, at different dates, with his *Bourreria spinifex* and *B. montana*, as will be presently shown, which renders the synonyms difficult of explanation.

13. *Bourreria spinifex*, nob. (non Griseb.);—Bourreria divaricata, *Griseb.* (*non Don*) *Cat. Pl. Cub.* 210;—Ehretia spinifex, *R. & Sch.* iv. 805; *DC. Prodr.* ix. 506;—ramis divergentibus, teretibus, ramulis in apice ramorum proximis, glabris, axillis spinuloso-cupularibus; foliis oblongis, apice obtusissimis aut rotundatis, imo obtusis, coriaceis, convexis, in costa valde sulcatis, nervis paucis immersis, arcuatim nexis, marginibus valde revolutis, supra nitentibus, tuberculis albis exasperatis, scabrido-pilosis, subtus fusco-opacis, subglabris, nervis prominentibus; petiolo glabro, limbo 8-plo breviore: racemis terminalibus, brevibus, sub-3-floris; calyce glabro, acute 5-dentato; corollæ tubo cylindrico, calyce duplo longiore, lobis oblongis, patentibus; stylo breviter bifido; drupa globosa.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 3118, sub nom. *B. divaricata*).

This plant quite agrees with the characters given by Römer and Schulz to their *Ehretia spinifex*. Dr. Grisebach, in 1862, referred a Cuban plant to this species, under the name of *Bourreria spinifex*, quoting the synonym of those botanists; but in 1866 he converted this same plant (Wright, 3123) into a new species, *B. montana*, which he pronounced to be distinct from Römer and Schulz's species; and at the same time he referred Wright's plants 1365, 3118, and 3136 to his *Bourreria divaricata* (not Don's), and synonymous with *Ehretia spinifex*,

R. & Sch.: I have shown the latter corresponds with Wright's 3118, while 1365 (in parte) and 3136 belong to Don's *B. divaricata.* Here is a sad confusion, which runs alike through most of the determinations of Dr. Grisebach in this family, all which have been made incautiously and in too much haste.

This is a small shrub, with numerous divaricating branches, which soon become bare and rugose from the decadence of the leaves, the axils becoming somewhat spiniform; the leaves, solitary on each alternate node, are 8–10 lines long, 3–5 lines broad, on a petiole 1–1½ line long. The British-Museum specimen has only a single flower, the others probably having fallen away; its calyx is 3 lines long, the tube of the corolla 5 lines, the lobes 2½ lines long.

14. *Bourreria microphylla*, Griseb. Cat. Pl. Cub. 210;—ramulis tenuibus, teretibus, cinerascentibus, striatellis, glabris; foliis minimis, patentibus vel recurvis, ovalibus vel suborbicularibus, coriaceis, valde convexis, supra profunde viridibus, tuberculis piliferis albis magnis exasperatis, marginibus valde revolutis, subtus flavescentibus et pulverulento-glaucis; petiolo pubescente, limbo 12-plo breviore: racemis terminalibus, paucifloris; calyce subsericeo, 5-dentato; corollæ tubo calycem æquante, lobis rotundatis æquilongis.—In Antillis in savannis: *v. s. in herb. Mus. Brit.*, Cuba (Wright, 1365 in parte).

This specimen bears a ticket referring it, on the authority of Dr. Grisebach, to his *Bourreria virgata*, a very different plant; but it corresponds with his *Bourreria microphylla.* It is a shrub 4 feet high, with spreading branches, and branchlets about 3 inches long, with axils 1–3 lines apart, bearing solitary leaves 1½–3 lines long, 1–2 lines broad, on a petiole ⅛–¼ line long. I have not seen the inflorescence; but the above specimen shows two calyces from which the fruit has fallen; these are glabrous, pale outside, the teeth having tomentose margins.

15. *Bourreria linearis*, nob.;—fruticosa, ramis teretibus, striatis, tortuosis, nodosis; ramulis ultimis brevissimis, asperatis; foliis paucis, alternis, aut in nodis fasciculatis, mox delapsis, parvis, linearibus, spathulatis, rigidis, crassiusculis, marginibus valde revolutis, supra in costa profunde sulcatis, tuberculis albis setiferis valde scabris, subtus flavido-tomentosis; petiolo fulvo-tomentoso, limbo 10-plo breviore: racemis in ramulis novellis terminalibus, brevibus, paucifloris; calyce persistente, tubuloso, 5-fisso, laciniis obtuse ovatis, utrinque adpresse pilosulis; drupa globosa, rubra,

carnosa, piso minore, 4-pyrena, pyrenibus generis.—In Antillis: *v. s. in herb. Mus. Brit.*, Cuba, Faralloma Hermitage (Wright, 1365 in parte).

This is another distinct species, the last of the three included by Dr. Grisebach under the specific name of *virgata*—all as dissimilar as can be conceived to Swartz's plant. It forms a low bush, with gnarled rough branches. The axils of the short young branchlets, after the fall of the very deciduous leaves, are spinescent, and so very close together as to give them a muricated appearance. The leaves are 5–6 lines long, ½ line broad, the margins being so greatly revolute as almost to conceal the under surface, the petiole being ½ line long; the calyx is 1½ line long, coriaceous, cleft halfway into five rather obtuse lobes, and supports a red drupe 2 lines in diameter.

CREMATOMIA.

I have already alluded to this group of plants, which I have separated from *Ehretia*: it forms a series distinguished by very salient characters, the type of which is the *Bourreria exsucca* of Jacquin, a plant hitherto very indistinctly described and confounded with others. From a flower of the original typical plant, contributed by Jacquin himself, from herbarium specimens, and assisted by an analytical drawing of the structure of the fruit taken from a living plant, I have been enabled to complete the characters of the genus here proposed under the title of *Crematomia*, a name derived from *κρεμάω*, *suspendo*, and *τομή*, *sectio*, on account of its four carpellary achenia, suspended by stiff threads from the summits of a divided free axile column, somewhat after the manner of the suspended carpels in *Gouania*, many *Cruciferæ*, *Umbelliferæ*, and *Geraniaceæ*. The calyx is constructed as in *Bourreria*, only that its valvate segments adhere more firmly together, often splitting irregularly, by the swelling of the corolla and fruit, into two or three unequal divisions. The corolla is tubular and fleshy, with a border of five orbicular segments, shortly unguiculated and cordately auriculated at their base; the stamens are often pilose at their base, with anthers like those of *Bourreria*; so also is the style, only that it is always more deeply cleft for a distance never less than one-fourth of its length. The ovary is subconical, seated on a fleshy disk, and has a placentation similar to that already described in *Rhabdia*, *Cortesia*, *Ehretia*, and *Bourreria*. The drupaceous fruit has a thick coriaceous pericarp, that falls away, leaving a quadrately obovate cremocarp, which ultimately splits along its four angles, at first into two and afterwards into four equal achenia, angular within, flattish on the dorsal face, and somewhat winged on the margins, the dorsal side being thick and of a remarkable spongioid texture, composed of numerous very long narrow cells, which radiate towards the periphery, all covered by a reticulated membrane. A slender central column is found in the axis, which splits to the base into two parts that again subdivide, forming four equal, erect, rigid, aristiform supports, which are suddenly reflected at the summit into as many rigid funicular chords, whence the achenia are suspended at a point near their base. It is requisite that the fruit should dry in the open air to exhibit this structure completely. Upon the branch, after the fall of the leaves, the panicle remains, the pericarp dries and falls off, the carpels separate and are seen hanging from their spreading funicular supports; and when at length the achenia drop off, the divided column remains, supported by the persistent unequally ruptured calyx. In the ventral angle of each achenium is an indehiscent, somewhat osseous cell, of half its length, of an oblong shape; and upon one of its sides there is a longitudinal narrow channel, filled with soft matter and nutrient vessels which penetrate into the cell below its apex, and to which the single terete seed is attached in a manner similar to that described in *Rhabdia*. The lateral large open foramen leading into a pseudo-cell, a characteristic feature in *Bourreria*, is altogether wanting in *Crematomia*—a circumstance that affords a ready distinction between the two genera, which otherwise much resemble one another. This structure of the flower, ovary, and fruit renders *Crematomia* a valid genus of the *Ehretiaceæ*. The achenia, with their pericarpial covering, are well depicted in Richard's drawing of a Cuban plant.

All the known species of *Bourreria* are confined within the limit of the West-India Islands; several belonging to *Crematomia* have a similar origin; but one-half of its known species extend into the Columbian portion of the continent and into Mexico.

CREMATOMIA, gen. nov.—*Calyx* tubulosus, ad medium in dentes 5 acutos divisibilis, dentibus intus pilosulis, marginibus dense tomentosis, æstivatione valvatis, primum firme adhærentibus, demum segregatis, aut sæpe in lobis 2–3 inæqualibus constans, persistens. *Corolla* tubulosa, carnosula, *tubo* calyce longiore, fauce paulo ampliore, *limbo* 5-partito, laciniis orbicularibus vel ovalibus, imo brevissime unguiculatis et rotundatim cordato-auriculatis, patentibus, æstivatione quincuncialiter imbricatis. *Stamina* 5 (rarius 6),

laciniis alterna, tubo inserta; *filamenta* imo latiora, hic dense pilosa aut sparse pilosula, superne gradatim filiformia, exserta; *antheræ* 2-lobæ, lobis oblongis, fusco-coriaceis, a medio segregatis, superne collateraliter adnatis, in sinu oscillatorie affixis, lateraliter rima longitudinali alba utrinque dehiscentibus: *pollen* granosum, globosum, granis in pulverem farinosum niveum immersis. *Ovarium* conico-oblongum, *disco* brevi suffultum, striatum, glabrum, semiseptis 2 oppositis, parietalibus, utrinque bilamellatim reflexis, marginibus *ovulum* amplectentibus, hinc pseudo-4-loculare et 4-ovulatum. *Stylus* simplex, exsertus, apice fere ad medium 2-fissus, ramis rectiusculis, *stigmate* subpeltato singulatim munitis. *Drupa* majuscula, globosa, calyce persistente suffulta: *pericarpium* crasse coriaceum, utrinque nitens, maturitate deciduum; *mesocarpium* parcum, subcarnosum: *cremocarpium* persistens, sub-4-gonum, in achenia 4 primum bigemina, demum omnino solubile; *achenia* ventre angulata, extus subplana aut paulo convexa, lateribus subalata, *endocarpio* dorsali amplo, spongioso-reticulato, e cellulis plurimis vacuis elongatis radiatim centrifugis conflato, angulo ventrali 1-locularia, 1-sperma, loculis oblongis, subosseis, indehiscentibus, latere unico summum versus foramine parvo (intra canalem angustum vasiferum e basi adscendentem) perforatis: *columella* centralis, principio ad basin bipartita, mox iterum fissa in carpophora 4 rigida tenuia erecta ad summum adscendentia; hæc subito reflexa, chordas filiformes liberas ad achenia infra medium affixas simulant, et hoc modo achenia libera in aere suspensa sunt: *semen* teres, loculum implens, e foramine suspensum, structura *Bourreriæ* simile.

Arbores *et* arbusculæ *in America tropica et in Antillis indigenæ:* folia *alterna, oblonga, petiolata:* paniculæ *corymbosæ, terminales, sæpius laxe ramosæ;* flores *albi, mediocres, interdum majores:* drupæ *majusculæ, sæpius rubræ.*

1. *Crematomia Cumanensis*, nob.;—Rhamnus Cumanensis, *Loefl. Itin.* 182;—Ehretia exsucca, *Linn. Sp.* 275; *Willd. Sp.* i. 1078; *DC. Prodr.* ix. 508;—Ehretia cymosa, *Willd.* (*non Poir. nec Thonn.*) *in R. & Sch.* iv. 805; *DC. l. c.* 511;—arborescens, ramis teretibus, fusco-cinerascentibus, glabris, lenticellatis; foliis obovatis, acutis, imo cuneato-attenuatis, coriaceis, supra minute scabridulo-pilosulis, subtus pallidioribus, opace brunneis, glabris, minute rugulosis, marginibus paulo revolutis; petiolo tenui, sulcato, limbo 12–14-plo breviore: corymbis terminalibus, pedunculatis, dichotome multiramosis, compresso-angularibus, glabris; floribus brevissime pedicellatis, bracteolatis; calyce coriaceo,

glabro, inæqualiter 2–3-fido; corolla infundibuliformi, tubo calyce duplo longiore, lobis suborbicularibus, imo auriculato-cordatis, patentibus, filamentis paulo supra basin insertis, imo dilatatis et villosulis, mox filiformibus, ciliatis, longe exsertis; antheris linearibus, imo fissis, in sinu oscillatoriis; stylo tenuissimo, longe exserto, pro quarta parte bifido; drupa 4-gone globosa, 4-pyrena, pyrenibus dorso spongiosis.—In Venezuela: *v. s. in herb. Mus. Brit.*, Cumana (Moritz, 383).

A tree twenty feet high, called by the natives Guatacaré; its leaves are 3–3½ inches long, 1½ inch broad, on a petiole 3 lines long: the panicle is 4 inches long and broad; the calyx is 4 lines long, glabrous, striated, the tube of the corolla 9 lines long, the lobes of the border 4 lines in diameter; the stamens exserted 4 lines beyond the mouth; the anthers 1½ line long; the style as long as the stamens.

2. *Crematomia grandiflora*, nob.;—Ehretia grandiflora, *Poir. Dict. Suppl.* ii. 3; *R. & Sch. Syst.* iv. 529; *DC. Prodr.* ix. 510;—ramulis patentibus, teretibus, substrictis; foliis ovatis, apice obtusis, imo attenuatis, inæquilateris, nervosis, utrinque glabris, subtus reticulatis, breviter petiolatis: paniculis corymbosis, terminalibus; calyce 5-dentato, subpubescente, cinereo; corollæ magnæ tubo calyci æquilongo, lobis longioribus, ovatis, patentibus, rubellis; antheris oblongis, oscillatoriis; stylo apice bifido.—In Antillis, ins. S. Domingo (*non vidi*).

This species appears to differ from *C. Guatimalensis* (*Bourreria grandiflora*, Griseb.) in its smaller, more oval leaves, and a corolla with larger reddish lobes. The leaves are about 2 inches long, 1½ inch broad.

3. *Crematomia Guatimalensis*, nob.;—Beurreria grandiflora, *Bertol. Fl. Guat.* 10 (*non Griseb.*);—Ehretia Guatimalensis, *DC. Prodr.* ix. 507;—ramulis apice subpubescentibus; foliis ellipticis vel elliptico-oblongis, utrinque acutis, basi angustioribus, utrinque subglabris vel e tuberculis minutis obsolete scabridulis, planis, nervis tenuibus, immersis, supra opacis, subtus pallidioribus; petiolo subtenui, canaliculato, glabro, limbo 6-plo breviore: panicula corymbosa terminali, dichotome ramosa, ramis angulato-compressis, pubescentibus, bracteolis foliolosis, ovato-lanceolatis; calyce e laciniis cohærentibus irregulariter 2–3-fido, coriaceo, extus glabro, intus subsericeo; corollæ albæ tubo infundibuliformi, calyce triplo longiore, fauce ampla, limbi lobis suborbiculari-ovatis, imo cordato-auriculatis, patentibus; filamentis paulo

supra basin tubi insertis, imo dilatatis et villosis, exsertis; antheris fusco-coriaceis, mucronatis, rima nivea utrinque dehiscentibus, oscillatoriis; stylo stamina æquante, apice bifido.—In Guatemala et Venezuela: *v. s. in herb. Mus. Brit.*, La Guayra prope Las Cadugras (Moritz, 907).

As the above characters, drawn from the Venezuelan plant, accord, with few exceptions, with the description given by Bertoloni of his species from Guatemala, I have referred it there. It differs from the preceding species, with which Dr. Grisebach confounds it (Cat. Pl. Cub. p. 204) in the much larger tube of the corolla, which is white (not reddish). The *Beurreria grandiflora* of that botanist, from Cuba (Wright, 3122), without any description, I believe to be a very different plant, though I have not seen it.

The axils are ¾–1¼ inch apart; the leaves are 3½ inches long, 1¾ inch broad, on a petiole 7 lines long: the panicle is diffusely branched, has spathulately linear deciduous bracts, 2–5 lines long, all pubescent; the pedicels are 1 line long; the calyx is 4 lines long; the tube of the corolla 1 inch long, the lobes of the border ½ inch long.

4. *Crematomia Guildingiana*, nob.;—ramis teretibus, subglabris, superne parce puberulis, cum axillis ramulorum ultimorum valde approximatis; foliis elliptico-oblongis, apice sensim acutis, imo acutioribus, utrinque glabris, opacis, supra fusco-viridibus, nervis subimmersis, subtus pallidioribus, nervis prominulis, marginibus vix revolutis; petiolo sulcato, obsolete puberulo, limbo 8-plo breviore: panicula corymbosa, terminali, dichotome expansa, ramis subcompressis, subglabris; pedicellis brevibus; calyce coriaceo, 5-dentato, aut inæqualiter subtrilobo, extus adpresse puberulo; corollæ tubo infundibuliformi, calyce plusquam duplo longiore, lobis obtuse ovatis, imo breviter cordato-auriculatis, expansis; filamentis supra basin tubi insertis, imo dilatatis et villosis, mox puberulis, sursum filiformibus, paulo exsertis; antheris sublinearibus, rugulosis, mucronatis, imo divergentibus, oscillatoriis; stylo exserto, tenuissimo, apice pro quarta parte bifido; ovario disco insito; drupa carnosa, acheniis 4 demum segregatis, e carpophoris suspensis, dorso spongiosis.—In Antillis: *v. s. in herb. Hook.*, in flore et fructu, ins. S. Vincenti (Guilding, cum icone e plant. viv.).

The details shown in the analytical drawing of the Rev. W. Guilding, in regard to the peculiar mode of suspension of the achenia, are amply confirmed by the specimen which accompanies it; but he does not appear to have seen the pericarpial covering of the fruits, which had fallen away at the period when he gathered the plant: this deficiency, however, is supplied by the Cuban specimens of *Crematomia calophylla*, and by Richard's drawing of the same. It is now easy to understand the rough and incomplete sketch by Jacquin of the fruit of his *Beurreria exsucca*, which it was impossible to comprehend before, in the absence of any specimen.

The branchlets are stout, 3 lines in thickness, with axils $\frac{1}{2}$–$\frac{3}{4}$ inch apart; the leaves are $2\frac{1}{2}$–3 inches long, $1\frac{1}{4}$–$1\frac{3}{4}$ inch broad, on a petiole 4 lines long. The corymb is $2\frac{1}{2}$–3 inches long; the calyx 3 lines long; the tube of the corolla 8 lines long, the lobes 5 lines long; the filaments 8 lines long; the ovary and style 12 lines, the segments of the latter $2\frac{1}{4}$ lines; the achenia are 7 lines long, $5\frac{1}{2}$ lines broad, narrowing upwards and somewhat cordately inflected at the base; the cell and its contained seed are 3 lines long.

5. *Crematomia Jacquiniana*, nob.;—Beurreria exsucca, *Jacq. Amer.* 45, tab. 173. fig. 17; *Lam. Dict.* i. 527;—Ehretia exsucca, *Linn. Sp.* 275; *DC. Prodr.* ix. 508;—arborescens, ramis interdum subscandentibus; foliis ovatis, acutis, glaberrimis, petiolatis: corymbis racemosis, subterminalibus; floribus pedicellatis, albis, suaveolentibus; calyce urceolato, irregulariter trifido, extus glabro, laciniis intus villosis; corollæ tubo calyce triplo longiore, lobis suborbicularibus, imo auriculato-cordatis, cum tubo crassiusculis, patentibus; filamentis infra medium insertis, longe exsertis; antheris acutis, oscillatoriis; stylo apice bifido, exserto; fructu (delapso pericarpio?) sec. Jacq. viridi, 4-gono, apice obtuse angustato, 4-sulcato, ad angulos partibili, demum in achenia 4 libera in arbore persistentia soluto.—In Nova Granada ad Carthagenam: *v. s. in herb. Mus. Brit.* (flos tantum, ab ipso Jacq. communicatus).

This species, which is clearly identified by the flower sent by Jacquin, differs from the others I have seen, in its more fleshy texture and different proportions. It differs from all in its subscandent habit and the country of its origin; it agrees with *Ehretia grandiflora*, Poir., in the size of its leaves, but differs in its white (not reddish) flowers, which have a much longer tube and shorter lobes.

It is a tree fifteen feet high; its leaves are 2 inches long; the calyx is $2\frac{1}{2}$ lines long, the tube of the corolla 6 lines long, 1 line broad at its base, 5 lines in diameter in the mouth; the lobes are 4 lines in diameter, much overlapping one another by their auricular bases; the stamens extend $2\frac{1}{2}$ lines, the style 3 lines beyond the mouth.

6. *Crematomia venosa*, nob.;—ramulis teretibus, subvirgatis, striatis, glabris; foliis ovatis, apice rotundatis, mucronatis aut emarginatis, imo obtusis, subinæquilateris, in petiolo breviter subito decurrentibus, undique glaberrimis, supra viridibus, costa sulcata, nervis divergentibus rubellis arcuatim nexis, prominule reticulatis, subtus pallidioribus, nervis rubescentibus et prominulis, planis, marginibus paulo repando-sinuolatis; petiolo crassiusculo, sulcato, glabro, limbo 4–8-plo breviore: panicula terminali, laxe ramosa, ramis dichotomis, divergentibus, compressis, glabris; bracteis valde deciduis; floribus fere sessilibus; calyce extus obsolete puberulo, 5-dentato, dentibus acutis, intus cano-subsericeis; corollæ tubo calyce longiore, lobis ovalibus, imo auriculatis; filamentis medio tubi insertis, parce scabridule pilosulis, exsertis; antheris coriaceis, fuscis, rugosis, submucronatis, oscillatoriis; stylo pro tertia parte bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Dr. Alex. Prior).

The branches are 1 or 2 lines in thickness, their axils are ½–¾ inch apart; the leaves are 3¼–3¾ inches long, 2 inches broad, on a petiole 5–10 lines long. The terminal, very spreading panicle is 5 inches long (including the peduncle of 1¾ inches) and equal in breadth: the flowers are in bud, the calyx being 3 lines long.

7. *Crematomia calophylla*, nob.;—Ehretia calophylla, *Rich. in La Sagra, Fl. Cub.* ii. 112, tab. 61; *Walp. Ann.* v. 541;—Bourreria reticulata, *Griseb. Cat. Pl. Cub.* 210;—ramulis angulato-compressis, glabris; foliis oblongis, apice rotundatis, imo obtuse attenuatis et paulo inæquilateris, rigidis, subcoriaceis, utrinque glaberrimis, supra læte viridibus, lucidis, aut interdum maculis albis crebris pustulatis (nullo modo scabris), costa rubella, nervis valde divaricatis reticulatis, subtus pallidioribus, flavide glaucis, costa crassa nervisque valde prominentibus, marginibus paulo revolutis; petiolo subvalido, sulcato, rigido, glabro, limbo 3–5-plo breviore: panicula terminali, valde expansa, dichotome ramosa, glaberrima, ramis longis, validis, striato-compressis; calyce crasso-coriaceo, glabro aut obsolete piloso, acute 5-dentato, dentibus margine tomentosis, imo bractea lineari æquilonga decidua donato; corollæ tubo calycem æquante, intra pubescente, lobis oblongis, rotundatis, imo brevissime auriculatis, tubo paulo longioribus; filamentis imo dilatatis et pubescentibus, sub fauce insertis, cum costis totidem pilosulis continuis, exsertis; antheris mucronatis, lobis oblongis, superne adnatis, ad medium divaricatis, in sinu oscillatoriis; stylo his attingente, ad medium bifido; drupa

majuscula, globosa; pericarpio coriacco, utrinque nitido, pulpa paucissima; acheniis 4 dorso spongiosis, columella centrali affixis.—In Antillis: *v. s. in herb. Hook.*, Cuba (specim. typ. a La Sagra commun.); Cuba (Wright, 3124); *in herb. Mus. Brit.*, Cuba (Wright, 3124, sub nom. *B. reticulata*).

I can perceive no essential difference between La Sagra's typical specimen and Wright's plant, which Dr. Grisebach made a separate species, both (especially the Museum specimen) agreeing admirably with Richard's drawing. It is described as a small tree, the branches being furnished with large shining leaves, approximated towards their extremities: the leaves are 3–5 inches long, 1½–2½ inches broad, on a stiff petiole 1–1¾ inch long. The panicle is longer and stouter in fruit, when it is 6½ inches long and broad, with long, thick, divaricating branches, the peduncle being 2½ inches long; the articulated pedicels are ½ line long; the calyx 3 lines long, the tube of the corolla 2 lines, its lobes 3½ lines long; the filaments are subpuberulous; the drupe is 9 lines long, 8 lines in diameter, supported on the stellated coriaceous calyx; the achenia correspond in structure with the generic character.

8. *Crematomia coriacea*, nob.;—ramulis angulato-striatis, glabris, rubescentibus; foliis ovatis, apice rotundis et mucronulatis, imo rotundis et breviter auriculato-cordatis, coriaceis, undique glaberrimis, supra subpallidis, in costa nervisque valde divaricatis sulcatis, aut profundius valleculatis, venis grossis minute reticulatis, marginibus subrevolutis, subtus concoloribus, nitidiusculis, costa nervisque transversim venosis valde prominentibus; petiolo crasso, semitereti, supra sulcato, ruguloso, limbo 10-plo breviore: panicula laxe corymbosa, terminali, dichotome ramosa, ramis longiusculis, compressis, nitentibus, rubellis, glabris. —In Antillis: *v. s. in herb. Hook.*, Cuba (La Sagra).

This is very different from *C. calophylla*, to which it was referred by De Franqueville, who obtained the specimen from La Sagra. It is fructiferous, from which all the drupes have fallen. The species is remarkable for its oval, thick, coriaceous leaves, which are cordate at base, with two imbricated auricular lobes, and are deeply channelled along the midrib and unusually spreading nervures. The branchlets are thick, with axils ½–1 inch apart; its leaves are 2½–3¼ inches long, 1½–2½ inches broad, on a very stout petiole 3–4 lines long; the spreading panicle is 3½ inches long.

9. *Crematomia attenuata*, nob.; — Bourreria Domingensis,

Griseb. in Flor. Brit. W. Ind. 482; — Bourreria calophylla, *Griseb. Cat. Pl. Cub.* 209; *Pl. Wright. Cub.* 528;—Bourreria tomentosa, *Griseb.* (*non Don*) *Cat. Pl. Cub.* 209;—ramulis glaucis, rugulosis, glabris; foliis late ovatis aut ovato-oblongis, apice rotundatis vel paulo obtusis, subacutis et mucronulatis, a medio ad imum cuneatim angustatis, supra glaberrimis aut in costam sulcatam subpuberulis, læte viridibus, nitentibus, reticulatis, nervis tenuibus, subtus pallide glaucis vel dealbatis, glandulis minutissimis nitentibus sæpe munitis, costa puberula, marginibus subrevolutis; petiolo superne sulcato, glabro, limbo 5–7-plo breviore: panicula terminali, dichotome ramosa, cinereo-tomentosa, folio paulo breviore, bracteis minutis, valde deciduis; calyce 5-dentato, cano-sericeo; corollæ tubo calyce dimidio longiore; staminibus paulo supra medium tubi insertis, exsertis; stylo pro tertia parte bifido; drupa globosa, calyce stellato suffulta, cerasi mole, pyrenibus 4 generis.—In Antillis: *v. s. in herb. Hook.*, Jamaica, Albion Pen (Dr. Alex. Prior); Cuba (Wright, 3120, in flore); ibid. (Wright, 3124 *a*, in fructu).

Dr. Grisebach has referred the first-mentioned specimen to *Bourreria Domingensis*, the second to *B. tomentosa*, and the third to *B. calophylla*, all which species differ extremely from the species under consideration, which is well marked by the characters above given. The leaves in the Jamaica specimen are a little broader and more rounded at the apex; but they are all in like manner much cuneated at the base. The drupe is smaller than in *Crematomia calophylla*; but its achenia prove that it belongs to the same genus, and not to *Bourreria*, certainly not to either of the above-mentioned species. Its leaves are 2½–4 inches long, 1¼–2¾ inches broad, on a petiole 4–7 lines long.

10. *Crematomia elongata*, nob.;—ramulis compresso-teretibus, subnitidis, junioribus subtomentosis; foliis lanceolato-oblongis, apice sensim obtuse angustatis, imo cuneatis aut obtusiuscule attenuatis, supra e tuberculis parvis demum albidis adpresse scabrido-pilosis, nervis tenuibus immersis, subtus pallidioribus, glauco- vel ferrugineo-tomentellis, nervis paulo prominentibus, marginibus revolutis; petiolo tenui, canaliculato, recto, puberulo, limbo 6-plo breviore: panicula terminali, dichotome ramosa, cinereo-tomentosa, folio vix longiore; calyce 5-dentato, velutine puberulo, dentibus intus sericeis; corollæ tubo calyce paulo longiore, lobis suborbiculatis, imo cordato-auriculatis; staminibus medio tubi insertis, antheris oscillatoriis, exsertis; stylo pro

tertia parte bifido, stigmatibus peltato-clavatis.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Bancroft); ibid. (Macfadyen).

A species distinguishable by its very elongated leaves, which are 3–4½ inches long, 1¼–1¾ inch broad, on a petiole 6–9 lines long.

11. *Crematomia formosa*, nob.;—Ehretia formosa, *DC. Prodr.* ix. 510;—ramulis teretibus, striatis, glabris, axillis approximatis; foliis divaricatis, ellipticis, apice subacutis, imo acutiuscule vel obtuse attenuatis, submembranaceis, supra opacis, subnitidis, glabris vel in nervis tenuibus immersis tantum puberulis, subtus pallidioribus, cinereo-glaucis, sparse puberulis; petiolo tenuissimo, striato, superne puberulo, limbo 4–5-plo breviore: paniculis corymbosis, terminalibus, ramulis tenuibus, compressis, pallidis, glabris; floribus speciosis; calyce turbinato, 5-dentato, extus brevissime tomentoso, intus cano-sericeo; corollæ carnosulæ tubo calyce æquilongo, lobis patentibus, rotundis, imo cordato-auriculatis, tubo duplo longioribus; filamentis subulatis, pilosulis, imo villosis, supra basin tubi insertis; antheris divaricatis, oscillatoriis, longiuscule exsertis; stylo ultra tertiam partem bifido, stigmatibus peltato-clavatis.—In Mexico: *v. s. in herb. Hook.*, Tehuantepec, prov. Oaxaca (Andrieux, 201); Sierra Pedro Nolasco (Jungensen, 710).

A tree thirty feet high, with branchlets 1½ line thick, and axils 3 lines apart; leaves 2½–3½ inches long, 1½–2 inches broad, on a slender divaricating petiole 5–10 lines long; the panicle is 2¼ inches long, with stiff spreading branches: calyx 3 lines long; tube of corolla the same length, its lobes 6 lines long.

12. *Crematomia revoluta*, nob.;—Bourreria revoluta, *H.B.K.* iii. 67;—Ehretia revoluta, *DC. Prodr.* ix. 507;—ramulis subteneris, teretibus, glabris; foliis oblongo-ovatis, apice rotundatis aut valde obtusis, imo cuneatis, crasso-coriaceis, supra profunde viridibus, lucidis, rude reticulatis, in costa rubescente sulcatis, undique glaberrimis, subtus pallidioribus, subrugulosis, nervis venisque reticulatis paulo prominentibus, marginibus revolutis; petiolo glabro, canaliculato, limbo 8-plo breviore: panicula racemosa, terminali, pauciflora; calyce carnosulo, 5-dentato, extus adpresse pilosulo; corollæ tubo calyce paulo longiore, lobis ovatis, imo auriculatis, dimidio brevioribus; staminibus medio tubi insertis, imo tuboque illinc pilosis, paulo exsertis; stylo pro tertia parte bifido; drupa globosa, rubra, pyrenibus 4 bigeminis.—

In Antillis (hacienda de Regla, Cuba): *v. s. in herb. Hook.*, S. Domingo (Schomburgk).

A species easily distinguished from all others: its axils are about ½ inch apart; the leaves are 1½–2 inches long, ⅞–1 inch broad, on a slender petiole 2½ lines long. The terminal panicle does not exceed an inch in length; the calyx is 3 lines long; the cylindrical tube of the corolla 4 lines, the lobes of the border 2½ lines long; the subglobose drupe is 7 lines in diameter.

13. *Crematomia molliuscula*, nob.;—ramulis tenuibus, e foliis delapsis nodulosis, compressis, cinereo-tomentellis; foliis ellipticis, utrinque sensim subacutis, apice sæpe obtusioribus, supra opacis, e tuberculis minutis scabride pilosulis, nervis tenuissimis immersis, obscure reticulatis, subtus pallidioribus, tomentellis, in costa nervisque vix prominulis canopubescentibus; petiolo tenui, superne sulcatulo, cano-tomentoso, limbo 8-plo breviore: panicula terminali, corymbosa, folio breviore, tomentosa, dichotome ramosa, pauciflora, ramulis bracteis parvis sublanceolatis donatis; calyce fere sessili, 5-dentato, submembranaceo, extus cano-sericeo, intus puberulo; corollæ tubo subinfundibuliformi, calyce paulo longiorc, lobis ovalibus, imo breviter auriculatis, tubo paulo brevioribus, patentibus; filamentis imo pilosiusculis, medio tubi insertis; antheris mucronatis, imo cordatis, longe exsertis; stylo ad tertiam partem bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica (Macnab); ibid. (Macfadyen).

A species differing from *C. velutina* in its larger, more fusiform leaves which are minutely scabridulo-pilose above, in the longer tube of its corolla, in the insertion of the filaments, and mucronate anthers. The axils are 3–4 lines apart; the leaves are 2½–4½ inches long, 1⅜–2¼ inches broad, on a petiole 4–7 lines long; the panicle is 1½–2 inches long; the calyx is 2½ lines long, with rather long acute teeth; the tube of the corolla 3 lines, its lobes 2½ lines long.

14. *Crematomia velutina*, nob.;—Ehretia velutina, *DC. Prodr.* ix. 508;—ramulis teretibus, substriatis, cinereo-tomentosis; foliis ovato-oblongis, obtusis, submucronulatis, imo subacutis, sæpe canaliculatim recurvis, supra opacis, velutino-pilosulis, in costa nervisque cano-pilosis, subtus paulo pallidioribus, cinereo-tomentosis; petiolo tenui, cano-tomentoso, limbo 7-plo breviore: panicula corymbosa, terminali, brevi, pauciflora, tomentosa; calyce submembranaceo, cano-pubescente, 5-dentato, dentibus submucronatis, intus velutinis; corollæ tubo calyce paulo longiore, infra medium ad inser-

tionem staminum pilosulo, lobis subrotundis, imo auriculato-cordatis; filamentis imo pubescentibus; antheris coriaceis, rugosis, basi divergentibus, exsertis; stylo fere ad medium bifido.—In Antillis: *v. s. in herb. Hook.*, Jamaica, Port Henderson (Lane).

Its leaves are 1½–1¾ inch long, 9–10 lines broad, on a petiole 2½–3 lines long: the panicle is 2 inches long; the calyx is 3 lines long, the tube of the corolla 4 lines, the lobes 3 lines long; the very immature drupe is 3 lines in diameter.

15. *Crematomia spathulata*, nob.;—ramulis subtenuibus, teretibus, cinereis, junioribus adpresse pilosulis; foliis longe spathulato-oblongis vel lanceolato-oblongis, obtusis, supra obscure viridibus, scabrido-asperatis, e tuberculis albis rigide pilosis, subtus pallidis vel brunnescentibus, pilis simplicibus rigidis adpressis vestitis, fere enerviis, marginibus revolutis; petiolo cano-pubescente, limbo 12-plo breviore: racemis folio brevioribus, aut terminalibus vel e ramulis novellis brevissimis folio unico munitis ortis, 4–6-floris; floribus brevissime pedicellatis; calyce fere ad medium 5–6-dentato, dentibus mucronulatis, utrinque cano-velutino; corollæ tubo calyce paulo longiore, lobis 5–6, rotundis, imbricatim expansis; staminibus 5–6, medio tubi insertis; antheris longe exsertis, mucronulatis; stylo ultra quartam partem bifido.—In Mexico: *v. s. in herb. Mus. Brit.* (ex herb. Pavon sub nom. *Ehretia exsucca*).

The specimens bearing Pavon's name, in his own hand, are inscribed in pencil, by D. Don, *Cortesia spathulata*; but it certainly does not belong to that genus. Its branchlets are slender, with axils 3–5 lines apart; the leaves are 1–1¾ inch long, 3–7 lines broad, on a petiole 1–1½ line long; racemes little more than ½ inch long, pedicels ½–1 line long; calyx 3 lines long; tube of corolla 5 lines, wider in the mouth, lobes of border 3 lines long; anthers exserted 2½ lines beyond the mouth of the tube.

16. *Crematomia Kunthiana*, nob.;—Bourreria exsucca, *H.B.K.* iii. 67 (*non Linn. nec Jacq.*);—ramis teretibus, glabris, incanis, junioribus pubescentibus; foliis obovatis, obtusis, rotundatis, coriaceis, reticulato-venosis, sæpius subglabris, utrinque (præsertim in nervis) strigoso-pubescentibus; petiolo canaliculato, pubescente aut glabro, cum margine ciliato, limbo 10-plo breviore: paniculis terminalibus, corymbosis, pedunculatis, dichotome ramosis, pubescentibus; floribus sessilibus; calyce irregulariter 2–3-fido, subpubescente, laciniis acutis; corollæ tubo cylindraceo, calyce longiore, lobis

5, rotundatis, patentibus; staminibus 5, tubo insertis, corolla æquilongis, imo villosis; stylo bifido, stigmatibus capitatis; fructu 4-gone globoso, depresse rostrato, in achenia 4 spongiosa demum soluto.—In Venezuela, prope Cumana (*non vidi*).

This is indigenous with *C. Cumanensis*, and is also called Guaticaré by the natives; but it differs from it in its rounder leaves, not cuneate at base, of only half their size, on a shorter pubescent petiole, in its pubescent inflorescence with sessile flowers, its tomentose calyx, its corolla with a shorter and more cylindrical tube. Its leaves are 1½ inch long, on a petiole 1–2 lines long. It is a tree 20 feet high.

17. *Crematomia Andrieuxii*, nob.;—Ehretia Andrieuxii, *DC. Prodr.* ix. 510;—ramulis teretibus, flexuosis, rugosis, cinereotomentosis; foliis ovatis, imo rotundiusculis, apice obtusis aut obtusissimis, naviculari-recurvis, marginibus plicato-undulatis, utrinque canescenti-pubescentibus, nervis parallelis, divergentibus; petiolo cano-velutino, limbo 8-plo breviore: panicula subcorymbosa, terminali, breviuscula, dichotome ramosa, cano-velutina; floribus majusculis, capitato-aggregatis, brevissime pedicellatis; calyce breviter campanulato, 5-dentato, utrinque velutino; corollæ tubo calycem vix excedente, late infundibuliformi, lobis rotundis, imo late cordato-auriculatis, patentibus, tubo duplo longioribus; filamentis imo villosis, sub fauce insertis, exsertis; stylo pro tertia parte bifido.—In Mexico: *v. s. in herb. Hook.*, Puebla (Andrieux, 200).

A very distinct species, apparently of low growth, with very rough, flexuose, tomentous branchlets, with axils 3 lines apart; leaves 1–1¼ inch long, ½–¾ inch broad, on a patent or reflected petiole 1½–2 lines long: panicle 1¼ inch long, with crowded flowers; calyx 2 lines long and broad; tube of corolla 2 lines long, lobes 4 lines long.

18. *Crematomia fasciculata*, nob.;—Ehretia fasciculata, *H.B.K.* iii. 66; *DC. Prodr.* ix. 508;—Lutrostylis inermis, *Don, Dict.* iv. 391;—ramosissima, ramulis teretibus, albescentibus, glabris; foliis in summo ramulorum brevissimorum 3 vel 4, pseudo-fasciculatim approximatis, obovato-oblongis, obtusis, basi acutis, subcoriaceis, nervosis, reticulatis, utrinque glabris, margine ciliatis, supra læte viridibus, subtus pallidioribus; petiolo canaliculato, tenuissimo, ciliato, limbo 5–6-plo breviore: paniculis corymbosis, terminalibus, brevissimis, dichotome ramosis, ramis angulatis, pubescentibus; calyce 5-fido, dentibus acute ovatis, margine tomentosis;

ovario depresse globoso, sub-4-gono, glabro; stylo fere ad basin diviso, laciniis erectis, stigmatibus subcapitatis; drupa globosa, piperis mole, pyrenibus 4, monospermis.—Prope Cumana (*non vidi*).

The above characters, from Kunth's description, conform with this genus, only that the style is more deeply divided than usual: the specimen from which they were taken, however, was stated to be incomplete, and apparently without flowers and with immature fruit. We find a parallel of the almost fasciculate leaves in *C. Guildingiana* and in some species of *Bourreria*. The leaves are 2 inches long, on a petiole 4–5 lines in length; the panicle is 1 inch long; the placentation of the ovary after the fall of the corolla conforms to the character of the genus.

19. *Crematomia* (?) *huanita*;—Morelosia huanita, *Ll. et Lex. Nov. Veg. Desc.* 1; *Don, Dict.* iv. 392;—ramulis tortuosis, ultimis deformatis, angulatis; foliis in extremitate ramulorum ovatis, nitidis, integerrimis, longe petiolatis: paniculis corymbosis, terminalibus; floribus plurimis, sessilibus, articulatis et caducis, odoratissimis; calyce coriaceo, ventricose tubuloso, 5-fido; corollæ tubo calyce subbreviore, lobis rotundis, æstivatione inter se cucullatim imbricatis, demum patentissimis; filamentis medio tubi insertis, subulatis, imo tomentosis; antheris exsertis, sagittatis, polline albido; ovario conico, striato; stylo apice 2-fido, cum stigmatibus clavatis; drupa globosa, sub-4-gona, subcarnosa, coriacea, nitida, styli vestigio apiculata, imo laciniis calycinis circumdata; nuce oblonga, 4-sulcata, loculis 4 monospermis (an in acheniis 4 demum solubili?).—In Mexico, ad Urupuam, prov. Mechoacan (Valladolid) (*non vidi*).

The *Morelosia* of La Llave and Lexarza has always been a genus of doubtful position: by its authors it was considered to be near *Cordiaceæ* on the one hand, and near *Ebenaceæ* on the other. Endlicher placed it after *Symplocos*, stating that its ovary was inferior and adnate to the calyx—an error arising from an ambiguous expression in its original character. Prof. De Candolle showed (Prodr. x. 177) that it cannot belong to *Borragineæ*, *Ebenaceæ*, or *Styraceæ*. The characters given of it are sufficiently clear, showing that its ovary is superior and enclosed in a *tubular perigynous corolla*, and that its fruit is supported by the ruptured *segments of the calyx*. The error above-mentioned has arisen from the expression of the author, "calyx adherens," meaning *persistent* or attached to the base of the drupe. Its bifid style, combined with its other characters, shows that it belongs to *Ehretiaceæ*, and either to *Bourreria* or *Crematomia*, probably the latter, on account of its Mexican origin, the short tube of the corolla, the large imbricated lobes of its border, and the stamens tomentose at base: it is a species near *C. formosa*, from which it appears to differ little. The character of the fruit was probably drawn from the drupe in an immature state, when the achenia were agglutinated together.

It is described as a tree of middle size, with a scabrid, rough trunk, its leaves being 3–4 inches long, upon elongated petioles.

On the Comparative Carpical Structure of the Ehretiaceæ and Cordiaceæ.

Thus far the carpical structure of the *Ehretiaceæ* has been explained, especially under the typical form of *Ehretia*; and it will tend to a better comprehension of the subject if I offer a few observations upon *Cordia*, because a very distinguished botanist has proposed to amalgamate *Ehretiaceæ* with *Cordiaceæ*. M. Baillon, in an instructive analysis of the ovary of *Cordia* (Adans. iii. 1, pl. 1), points to the analogy existing in the early development of the ovaries of *Cordia* and *Heliotropium*, and, without sufficient consideration of the subject, he pronounces these two genera to be inseparable; and, as the latter has been referred by some to *Ehretiaceæ*, he would unite the *Cordieæ*, *Ehretieæ*, *Heliotropieæ*, and *Borragineæ* into one family (*Cordiaceæ*). He thus divides it into two groups:—

1. *Borragineæ* proper.
2. *Cordiaceæ*, subdivided into
   - A. *Cordieæ*, having an embryo with plicated cotyledons.
   - B. *Heliotropieæ*, with simple cotyledons, without albumen.
   - C. *Tournefortieæ*, with simple cotyledons, with albumen.

But he does not state in which of these he would place the *Ehretiaceæ*.

These were the inferences he drew from his examination of the ovary of *Cordia ferruginea*; and he figured in the drawing above quoted the different stages observed from the period of the earliest development. He depicts the formation of two rudimentary carpels, which, by the inflexion of their margins, form a low dome with a unilocular cavity, in the bottom of which, intermediate between the four cardinal points, he perceived the evolution of four ovules, fixed in the base upon as many placentary ridges, while between them four septiform enlargements emanated from the wall of the cell at those cardinal points, leaving as many shallow fossets in the base of the cell, where the ovules became ensconced; the parietal emanations tapered upwards, gradually closing and joining together so as to form the style and stigma; and while the cells thus produced continue to grow downwards, the anatropous ovules remain attached to their original placentary supports, with their micropyles pointing upwards. At this stage, M. Baillon's description ceases, and he does not relate what occurs in the further development of *Cordia*, or what takes place in *Heliotropium* or *Ehretia*. The differences in these subsequent developments may, however, be summarized in the following manner.

In *Cordia* the four parietal emanations gradually approach each other, to form four equal partitions united in the axis, so that, at the period of flowering, the ovary is completely 4-celled, with a single subanatropous ovule in each cell, attached to the internal angle by a point below its apex or by its middle: the completion of this growth results in a drupaceous fruit, with a 4-celled osseous nut, each cell with a single seed suspended from below the summit, with a descending raphe terminating in the basal chalaza, the radicle of the exalbuminous seed being superior, and the cotyledons singularly plicated lengthwise. In the base and centre of the nut a large hollow is seen filled with placentary tissue, from which four sets of nourishing vessels issue, penetrating through a minute perforation near the summit of each cell, and terminating in the hilar attachment of the seeds. These are the very peculiar transformations that serve to distinguish the *Cordiaceæ* from all other developments of the same alliance.

In *Ehretia*, the ovary at an early stage is developed much after the manner of *Cordia*: the rudiments of four ovules emanate at the same points, and we see four similar intermediate parietal enlargements; but the basal placentary ridges combine to form a compressed elevated line, running from front to back across the axis, which continues to grow upwards, carrying the ovules with it, or, what amounts to the same thing, the principal growth of the whole takes place downwards; and in this manner the placentary columella is produced, which M. Baillon does not seem to have noticed. On the other hand, the parietal enlargements do not meet round the axis, as in *Cordia*, but are thrust aside after a while; the sinister and dexter emanations form semisepta, which, on approaching the columella, become suddenly reflected both ways, in parallel directions, to meet the corresponding parietal growths from the anterior and posterior walls: the consequence is that, at the period of the perfection of the flower, we see two bilocular carpels, each cell having a suspended ovule, while a vacant space runs across the axis anteriorly and posteriorly, filled with a compressed plate, which is the columella that supplies the nourishing vessels for the growth of ovules and seeds. This growth is constant throughout the *Ehretiaceæ*. The subsequent developments of the fruit in the different genera become modified in the manner already described.

In the *Borraginaceæ* there exists in the earlier stages a normally bicarpal development very similar to that of *Cordia*; but during the subsequent growth there is a tendency to a separation of the whole into four carpels, more or less bigeminately combined in pairs; the style remains free in the centre, supported upon a common gynobase, upon which the four carpels are affixed, and from which their ovules and seeds derive their nourishing vessels. This constitutes a subfamily marked by many peculiar characters: it requires, however, a thorough reinvestigation.

In the *Heliotropiaceæ*, the ovary, normally as well as at maturity, is bicarpellary, and the carpels are seated upon a conical gynobase of half their height. The style is usually very short, thick, and suddenly enlarged into a pulvinate or discoid form; and this is terminated by two sessile stigmata, more or less abbreviated. The fruit is generally exsuccous, divisible into four single or into two bilocular nuts; when four nuts are produced, there is a short placentary process that rises from the gynobase, to which the nucules are attached, and which answers the purpose of the columella seen in the *Ehretiaceæ*, in affording nutrition to the seeds; they are not bigeminately connected, as in that family.

Hence it will be seen that the *Cordiaceæ* possess characters which amply distinguish them from the *Ehretiaceæ*, *Heliotropiaceæ*, and *Borraginaceæ*. Nearly all the species of the family have been huddled into the single genus *Cordia*, because no one has taken the trouble to ascertain their true characters, their examination having been singularly neglected. It is remarkable that, among the 175 species of *Cordia* enumerated by De Candolle in his 'Prodromus,' the number of cells existing in the fruit is mentioned in only four cases, and utter silence is maintained throughout the whole in regard to the number of cells in the ovary, even in the generic character; and the point of suspension of the ovules and attachment of the seeds is everywhere ignored. Prof. Fresenius, in working the monograph of the family for Martius's 'Flora Brasiliensis,' contents himself with a few words in stating the ordinal character: in regard to its 4-locular ovary, he merely says there is an anatropous ovule in each cell, appended from the summit (which is not exactly true); and in regard to the seeds, he is silent about the existence of integuments, raphe, or chalaza, and none of his many analytical figures gives any information upon these subjects.

It is to be regretted that a very small amount of reliable information has been recorded concerning the carpical structure of the family. Among the few analyses that have been published, that of Gaertner is the most important: he shows in his work (i. 364, tab. 76. fig. 1) that of *Cordia* (*Sebestena*) *Myxa*, where the seed is suspended a little below the summit, with a raphe descending from that point to the base, its small radicle being superior, and its large fleshy cotyledons deeply plicated. A very different version of this structure, in a plant which he called *Cordia Myxa*, is given in Wight's 'Illustrations,' pl. 169: in the ovary the ovules are there shown to be quite erect, fixed in the basal angle of each cell; in the fruit the point of the attachment of the seed is not indicated, though it is drawn separately in fig. 11, without any mark of raphe or chalaza. This analysis is drawn by an Indian artist, and shows evident marks of inaccuracy; for the embryo, as shown in figs. 11 and 12, has a long pointed radicle, which is inferior (instead of superior). I therefore place more reliance upon the analysis of Gaertner, which is more conformable with my own observations, as will be shown presently. Wight's 'Icones,' also drawn by Indian artists, show the ovules in the same position as that indicated in the 'Illustrations,' in two other species of *Cordia*, in pls. 1379 and 1381, while in three other cases they are attached by their middle, as seen in plates 469, 1378, and 1380, which agrees with what I have generally found in the Brazilian species of *Cordia*. Prof. A. DeCandolle, in a note to the genus *Varronia* (Prodr. ix. 468), states that the ovules are there laterally affixed to the internal angle of the cells; and, again, in another note (p. 471) he adds that he found the ovules in *C. gerascanthus* attached as in *Varronia*, and that in *C. Chamissoniana* (a closely allied species) the point of attachment is nearer the base; but my observations upon the same species convince me that the connexion is at the middle, rather above than below it: in *C. discolor* he found the ovules fixed as in *Varronia*. My examination of the unilocular nut of *Cordia glabra* shows that the seed, which tightly fits the cell, is attached by a somewhat broad hilum to a spot a little below the middle of the cell, from which point a line of raphe, imbedded between the two integuments *, descends to a small basal chalaza; at the base of the nut, on the same side, a compressed open channel is seen, leading to the small abortive cells, filled with a chord of nourishing vessels which communicate with the hilum of the fertile seed. I have examined the ovaries and fruits of many Brazilian species of *Cordia*, all giving nearly similar results; and we may infer, from the preponderance of all this evidence, with a tolerable degree of confidence, that the ovules in the ovary or the seeds in their nuts are never affixed to the base of the cells, but are always attached nearer their middle, either above or below it, in the internal angle. In addition to this evidence, Roxburgh affirms of *C. serrata* that its ovules are affixed in the axis.

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* The seed, as stated by Gaertner, has two integuments: the outer one, of very friable texture, quite white, is composed of numerous large cells rather laxly agglutinated together; but it adheres firmly to the inner integument, which is opaque, very finely reticulated, like an extremely

The *Cordia Myxa* of Roxburgh appears to me a very different plant from that figured by Wight, under that name, in his ' Illustrations,' in which the leaves are larger and the fruit is more than double the size. I have examined the fruit of *Cordia oblongifolia*, Thw., which corresponds completely in size, especially in the persistent calyx, with the figure of *C. Myxa* in Wight's ' Illustrations.' Here the drupe is almost globular, with a short conical apex, and is seated in a thick, striated, cupular calyx, with a denticulated margin; the pericarp is extraordinarily thick, composed of numerous coarse woody fibres, after the manner of a cocoa-nut, within which is a fleshy mesocarp that envelops the nut: this nut is scarcely more than half the length and one-third the breadth of the pericarp, and is marked externally with a few deep hollow punctures; it has two fertile cells (the other two being abortive), with a large hollow cavity in the base, which is continued up the axis in a narrow channel which is open at the toothed apex of the nut; here the seed in each cell is attached by its middle, certainly not below it, at the point where the placentary vessels from the central columella enter the cells in communication with the descending raphe. Roxburgh's *Cordia monoica* has a much smaller drupe, which is oblong, only ½ inch long, with a much thinner, fibrous pericarp, and a fleshy mesocarp covering a nut which has only a single seed, attached near its middle. *Cordia Bantamensis*, Bl., a species closely allied to the above, has an oblong apiculated drupe, longer and narrower than in *C. oblongifolia*, seated in its cupular calyx: the nut is 1-celled, with the indications of

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thin waxy albumen; it is polished inside, and marked with several longitudinal nerve-like lines, produced by pressure between the plicatures of the cotyledons: but both these integuments are quite void of any vessels, except those of the raphe, which are enclosed in a sheath imbedded between them.

three abortive cells; the seed is here fixed above the middle of the cell, with a conspicuous descending raphe terminating in the basal chalaza. *Myxa* will make a good genus composed of several species, only a comparatively small portion of the 122 species classed in the section *Myxa* by De Candolle.

Cordia might conveniently be divided into several genera, for which good differential characters now exist. The form and æstivation of the calyx have already served for sectional divisions; but those of the corolla have been little attended to. Prof. De Candolle has noticed that the border of the corolla is campanulate and plicated convolutely in *Varronia*, as in the *Convolvulaceæ*; in *C. decandra*, Hook. & Arn., and *C. angiocarpa*, Rich., the stamens are twice or three times the usual number, and the lobes of the corolla, which are equally numerous, have a contorsively imbricated æstivation: in some species the border is corrugated, but in general the lobes of the border are quincuncially imbricated, in æstivation. It has not been noticed that in all the species forming the section *Gerascanthus* the border is cleft to the base into five equal flat lobes, which in æstivation are folded sinistrorsely, as in *Echites*: this generic name, established by P. Brown, might therefore be restored. The section *Rhabdocalyx* has one lobe of the border external in æstivation, while the other four are convoluted. The characters of the stamens and fruit afford other good indications. Besides the features I have mentioned as distinguishing *Myxa*, may be added that of its polygamous or monœcious flowers. *Cordia*, indeed, stands in much need of a thorough careful examination and redistribution.

There is one point deserving of notice—that, from some unknown cause, it rarely happens in *Cordia* that more than one ovule becomes fertilized; and this occurs equally in the plants of the Old and New World. The drupaceous nut is usually more or less gibbous and one-celled, with the seed attached as above described, in which case the abortive cells are generally seen on the flattened side, above the middle. May this almost constant abortion be owing to a defect in the stigmata, or to the puncture of insects, attracted perhaps by the nectariferous gland? I have seen cases where the flowers on a branch appeared quite perfect, but there was hardly one ovary in the whole that had not been attacked by a minute grub.

On a future occasion I will call attention to a new group of plants (the *Auxemmaceæ*), closely allied to *Cordiaceæ*, distinguished by the great augmentation of the calyx in fruit, by the peculiar æstivation of the corolla, and by its atropous ovules and seeds.

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  ramiflora, nob. 120
  virescens, nob. 125
Villaresia mucronata, Reiss. 117, 118
  scandens, Hassk. 114

W.

Welwitschia 161

DESCRIPTION OF THE PLATES

IN VOLUME II.

Plate 43.—Nastanthus agglomeratus.

Fig. 1, the entire plant, *natural size.* *Fig.* 2, one of its cæspitose scapes, with its leaf and hemispherical head of flowers. *Fig.* 3, transverse section of a scape and leaf, showing their fleshy texture: *both magnified.* *Fig.* 4, a fertile flower. *Fig.* 5, a sterile flower. *Fig.* 6, an achenium: *all natural size.* *Fig.* 7 is a fertile flower, *magnified.* *Fig.* 8, the corolla of the same, laid open, from which the staminal tube has been removed: here are seen the five teeth upon the surface of the corolla, which alternate with the filaments. *Fig.* 9, the stamens united below into a free monadelphous tube, upon which are seen the five glands alternating with the filaments, the tube being attached by its base to the tube of the corolla. *Fig.* 10, the same, cut open. *Figs.* 11 & 12 are the two last figures *more magnified.* *Fig.* 13, two of the segments of the corolla, to show the vesicular cucullate apex of the lobes. *Fig.* 14, longitudinal section of a fertile flower, in which is seen the articulated epigynous disk connected with the style, and which closes the base of the tube of the corolla. *Fig.* 15, a sterile flower, *magnified.* *Fig.* 16, the corolla of the same, cut open, showing the five minute teeth outside the free staminal tube, which has been removed. *Fig.* 17, the staminal tube laid open. *Fig.* 18, a sterile anther on a portion of the filament. *Fig.* 19, a transverse section of the same. *Fig.* 20, a sterile style and stigma. *Fig.* 21, a fertile ditto. *Fig.* 22, an achenium, *magnified.* *Fig.* 23, a transverse section of the same, across the middle. *Fig.* 24, longitudinal section of the same, showing the suspended seed. *Fig.* 25, the seed removed, showing the raphe. *Fig.* 26, the albumen. *Fig.* 27, longitudinal section of the same, with the embryo enclosed. *Fig.* 28, the embryo removed: *all magnified.*

Plate 44.—Nastanthus.

A. Portion of a plant of Nastanthus laciniatus.

B. Ditto of Nastanthus pinnatifidus.

C. Ditto of Nastanthus Gilliesii.

D. Ditto of Nastanthus scapigerus: *all natural size.*

PLATE 45.—GAMOCARPHA.

A. A plant of GAMOCARPHA PÖPPIGII, *nat. size.*

Fig. 1, a capitulum, seen from above. *Fig.* 2, a transverse section of the same, showing some of the foliaceous paleæ and the receptacle, from which the flowers have been removed. *Fig.* 3, some of the flowers with their foliaceous paleæ: *all nearly nat. size. Fig.* 4, a separate flower. *Fig.* 5, a transverse section of the corolla. *Fig.* 6, the monadelphous stamens laid open, marked with the five areolar glands: *all magnified.*

B. A plant of GAMOCARPHA GILLIESII.

Fig. 1, a flower, *nat. size. Fig.* 2, the corolla. *Fig.* 3, longitudinal section of ditto. *Fig.* 4, one of the cucullate lobes of its border: *all magnified.*

C. Plants of GAMOCARPHA PUMILA, *nat. size.*

D. A plant of GAMOCARPHA LIGULATA, *nat. size.*

PLATE 46.—BOOPIS.

A. Portion of a plant of BOOPIS RIGIDULA.

Fig. 1, a flower, *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, one of the lobes of its border. *Fig.* 4, the corolla, in longitudinal section, showing the attachment of the free monadelphous stamens with the areolar glands. *Fig.* 5, the stamens detached. *Fig.* 6, the style and stigma: *all magnified. Fig.* 7, a seed, and *Fig.* 8, its palea: *nat. size. Fig.* 9, a palea, *magnified. Fig.* 10, a seed, *magnified. Fig.* 11, a transverse section of the same.

B. A plant of BOOPIS GRACILIS, *nat. size.*

C. A plant of BOOPIS MULTICAULIS, *nat. size.*

PLATE 47.—BOOPIS.

A. A plant of BOOPIS SQUARROSA, *nat. size.*

Fig. 1, one of its flowers. *Fig.* 2, a flower *magnified. Fig.* 3, two of the paleæ. *Fig.* 4, a flower, *more magnified. Fig.* 5, its palea. *Fig.* 6, longitudinal section of the corolla. *Fig.* 7, monadelphous tube of the stamens, the lower contracted portion of the tube being agglutinated upon the corolla. *Fig.* 8, style and stigma. *Fig.* 9, longitudinal section of a seed. *Fig.* 10, transverse section of the same: *all magnified.*

B. A plant of BOOPIS? AUSTRALIS.

Fig. 1, a head of flowers, with its expanded involucre, *nat. size. Fig.* 2, a palea, *magnified. Fig.* 3, some of the flowers, *nat. size. Fig.* 4, a flower, *magnified. Fig.* 5, longitudinal section of the same, showing the free monadelphous tube of the stamens and the place of its attachment. *Fig.* 6, a seed: *all magnified.*

C. A plant of BOOPIS GRAMINEA, *nat. size.*

PLATE 48.—ANOMOCARPUS.

A. A plant of ANOMOCARPUS AXILLARIS, *nat. size.*

Fig. 1, the involucre, *magnified.* *Fig.* 2, the same, with its included flowers. *Fig.* 3, half of the involucre cut away, to show the single central spinose achenium surrounded by five others unarmed. *Fig.* 4, the same, with the achenia and flowers removed, to show the small receptacle. *Fig.* 5, the central flower. *Fig.* 6, an external flower. *Fig.* 7, longitudinal section of the corolla. *Fig.* 8, one of the unarmed achenia. *Fig.* 9, the central achenium. *Fig.* 10, a longitudinal section of the same: *all magnified.*

B. A plant of ANOMOCARPUS SUBSESSILIFLORUS, *nat. size.*

Fig. 1, an involucre, *magnified.*

C. Portion of a plant of ANOMOCARPUS ERYNGIOIDES.

Fig. 1, a flower. *Fig.* 2, its palea, *nat. size.* *Fig.* 3, a palea, *magnified.* *Fig.* 4, the corolla. *Fig.* 5, the monadelphous stamens, removed. *Fig.* 6, the same laid open, showing the areolar glands: *all magnified.* *Fig.* 7, one of the external achenia, with its long spines. *Fig.* 8, one of the inner achenia: *both nat. size.* *Fig.* 9, the same, *magnified.* *Fig.* 10, longitudinal section of the same. *Fig.* 11, the seed removed, showing its raphe. *Fig.* 12, section of the same.

PLATE 49.—ANOMOCARPUS.

A. Plants of ANOMOCARPUS PULVINATUS, with floral involucres, *nat. size.*

Fig. 1, a cluster of six fructiferous involucres increased in growth, *nat. size.* *Figs.* 2 & 3, a fructiferous involucre, seen sideways and from below. *Figs.* 4 & 5, involucels. *Fig.* 6, the enclosed flowers: *all slightly magnified.* *Fig.* 7, a corolla, *magnified.* *Fig.* 8, the stamens removed from it. *Fig.* 9, one of the outer unarmed achenia. *Fig.* 10, the central spinose achenium: *all magnified.*

B. Portion of a plant of ANOMOCARPUS TENUIS, *nat. size.*

Fig. 1, a head of flowers, *magnified.* *Fig.* 2, a flower with its palea, *more magnified.* *Figs.* 3 & 4, stamens. *Fig.* 5, one of the spinose achenia. *Fig.* 6, one of the unarmed achenia.

C. A plant of ANOMOCARPUS LEUCANTHEMUS, *nat. size.*

Fig. 1, a head of flowers, *magnified.* *Fig.* 2, a flower with its palea, *more magnified.* *Fig.* 3, the corolla. *Figs.* 4 & 5, stamens. *Fig.* 6, one of the unarmed achenia. *Fig.* 7, one of the spinose achenia: *all magnified.*

PLATE 50.—CALYCERA.

A. A plant of CALYCERA SQUARROSA, *nat. size.*

B. A plant of CALYCERA SINUATA, *nat. size.*

Fig. 2, the corolla. *Fig.* 3, the same, with three of the lobes thrown back, to show the monadelphous stamens. *Figs.* 4 & 5, the stamens. *Fig.* 6, the ovary in the floriferous stage. *Fig.* 7, the same, grown into a spinigerous achenium: *all magnified.*

C. A plant of Calycera viridiflora, *nat. size.*

D. A plant of Calycera spinulosa, *nat. size.*

Plate 51.—Acicarpa.

A. Portion of a plant of Acicarpa crassifolia, *nat. size.*

Fig. 1, a flower; and *Fig.* 2, its palea: *both nat. size.* *Fig.* 3, the ovary. *Fig.* 4, its palea. *Fig.* 5, the corolla: *all magnified.*

B. A plant of Acicarpa runcinata, *nat. size.*

C. A branch of Acicarpa procumbens, *nat. size.*

Plate 52.—Acicarpa.

A. A portion of a plant of Acicarpa tribuloides.

Fig. 2, a capitulum fructified: *both nat. size.* *Fig.* 1, longitudinal section of a flower, *magnified.*

B. Portion of a plant of Acicarpa pinnatifida, *nat. size.*

Plate 53.

A. Portion of a plant of Cochranea conferta.

Fig. 1, a flower, *nat. size.* *Fig.* 2, part of a spike, *magnified.* *Fig.* 3, corolla, seen from above. *Fig.* 4, corolla, seen sideways. *Fig.* 5, the same, cut open, to show the position of the stamens: *all magnified.* *Fig.* 6, stamens, *more magnified.* *Fig.* 7, disk, ovary, style, and stigma, *magnified.* *Fig.* 8, a fruit of two nucules. *Fig.* 9, one of the nucules. *Fig.* 10, a transverse section of the same. *Fig.* 11, a longitudinal section of the same. *Fig.* 12, a seed. *Fig.* 13, a longitudinal section of the same, showing the embryo enclosed in albumen. *Fig.* 14, the embryo separated: *all magnified.*

B. Portion of a branch of Messerschmidtia membranacea.

Fig. 1, a flower in æstivation, *magnified.* *Fig.* 2, the calyx. *Fig.* 3, a flower expanded. *Fig.* 4, a corolla separated. *Fig.* 5, calyx and pistil: *all equally magnified.* *Fig.* 6, corolla cut open, to show the manner of its æstivation and the position of its stamens. *Fig.* 7, the stamens removed, showing how they are coherent at their summits: *all magnified.* *Fig.* 8, stamens, *more magnified.* *Fig.* 9, the disk, ovary, style, and stigma, *magnified* as in *Fig.* 6. *Fig.* 10, a fleshy berry, *nat. size.* *Fig.* 11, one of its nucules, *magnified.* *Fig.* 12, the same, with half of the pericarp removed, to show the seed. *Fig.* 13, the seed removed. *Fig.* 14, longitudinal section of the same, showing the embryo enclosed in albumen. *Fig.* 15, the embryo separated. *Fig.* 16, the same, with the cotyledons displayed: *all equally magnified.*

PLATE 54.—ADENOCALYMNA PREHENSILE.

Fig. 1, part of a branch. *Fig.* 2, a capsular fruit. *Fig.* 3, one of the valves removed, showing the free replum on each margin of the dissepiment, and the attached seeds. *Fig.* 4, a seed, seen on its dorsal side. *Fig.* 5, the same, seen on the ventral face, showing its large hilum. *Fig.* 6, the same, seen on its edge. *Fig.* 7, a longitudinal section of the seed, showing the semi-bilocular cell formed within the crustaceous testa, in which are lodged the two lobes of the embryo. *Fig.* 8, a transverse section of the seed, showing the septiform division, with an aperture in the centre, in which the radicular portion connecting the two lobes of the embryo is confined. *Fig.* 9, the exalbuminous embryo covered by the inner integument, showing the two deeply bilobed cotyledons, connected by the small radicular portion, at one end of which is seen the small chalaza, and at the other the point of the radicle directed towards the hilum. *Fig.* 10, the embryo deprived of its inner integument. *Fig.* 11, a transverse section of the same.

PLATE 55.—ADENOCALYMNA? CÆSIUM.

A portion of the plant in fruit, showing the manner of the dehiscence of its capsule and its free replum.

Fig. 1, a seed, viewed on the ventral face. *Fig.* 2, the same, seen on the dorsal face. *Fig.* 3, a side view of the same, showing the hilum on the margin. *Fig.* 4, a seed with one of the faces of the discal portion removed, to show the septiform division with the aperture in the centre and the two cells thus formed, in which the lobes of the cotyledons are placed. *Fig.* 5, a transverse section of the same, with the septum having an aperture in the centre. *Fig.* 6, the embryo, covered by the inner integument, with the chalazal spot in the connecting portion. *Fig.* 7, the same, deprived of its integument.

PLATE 56.—TANAECIUM ALBIFLORUM.

A portion of the plant in flower.

PLATE 57.—TANAECIUM ALBIFLORUM.

Fig. 1, a capsule about to open at the apex, where the replum is beginning to separate from the edge of the dissepiment and from the margins of the two valves. *Fig.* 2, a transverse section of the same, showing the position of the dissepiment, the two bands of the replum, and the imbricated seeds, in regard to the two valves; on one of the valves are seen the cicatrices of the hilar points of attachment of the seeds, in four series upon each side. *Fig.* 3, a seed. *Fig.* 4, the same, seen on its edge, showing the hilum upon its margin. *Fig.* 5, the same, seen on its edge from one of its compressed margins. *Fig.* 6, a longitudinal section of the seed along the central line across the hilum. *Fig.* 7, a longitudinal section of the same through the margins, showing a semiseptum opposite the radicle, and the chalaza on the opposite side. *Fig.* 8, a transverse section of the same, parallel to the hilum. *Fig.* 9, the exalbuminous seed covered by its inner integument, showing its deeply lobed cotyledons, the point of the radicle in one sinus, and the chalaza in the bottom of the other. *Fig.* 10, the same, with the integument removed. *Fig.* 11, the same, seen on its edge: *all of the natural size.*

PLATE 58.—TANAECIUM PRÆLONGUM.

A portion of a branch in flower.

Fig. 1, a flower, with its extremely long tube bent. *Fig.* 2, a section of the upper portion of the same, showing the position of the stamens, with the sterile filament between the shorter pair. *Fig.* 3, a portion of the style, with the stigma: *all nat. size.*

PLATE 59.—TANAECIUM PRÆLONGUM.

Fig. 1, a capsule beginning to open. *Fig.* 2, one of the valves of the same, with the seeds removed, showing the free replum on each side, and the dissepiment, upon which are seen the cicatrices where the seeds were attached. *Fig.* 3, a transverse section of the dissepiment, which is partially bilaminar, with the margins inflected and attached to the valves; at the extremity some of the seeds remain, showing their position, the other part displaying the cicatrices corresponding to the hilar attachments of the seeds. *Fig.* 4, part of one of the valves, which is polished inside, except in a broad line along the margin, where it is rough, and from where the reflected margins of the valves have separated themselves. *Fig.* 5, a seed, on the ventral face, with its large marginal hilum. *Fig.* 6, the same, seen on its dorsal face. *Fig.* 7, the same, viewed in profile. *Fig.* 8, a seed, with a portion of the crustaceous testa removed, showing the septiform division with an aperture in its centre, where the radicle is esconced. *Fig.* 9, the embryo covered by its inner integument, the chalaza being in the sinus furthest from the hilum. *Fig.* 10, the same, with the integument removed, showing the radicle pointing to the hilum. *Fig.* 11, the same, seen in profile: *all nat. size.*

PLATE 60.—TANAECIUM BRASILIENSE.

Showing a portion of a climbing branch.

Fig. 1, a portion of a flowering branch, which is leafless. *Fig.* 2, a corolla. . *Fig.* 3, the calyx, style, and stigma belonging to it. *Fig.* 4, a corolla cut open, to show the position of the stamens. *Fig.* 5, the calyx laid open, showing the size of the ovary seated upon the disk: *all nat. size. Fig.* 6, the disk within the calyx, with the ovary cut transversely to show the position of the ovules upon the dissepiment, *magnified.*

PLATE 61.—ILEX PARAGUAYENSIS.

A. *Species typica*, portion of a branch in flower.

Fig. 1, racemes of one, two, or three flowers, *nat. size. Fig.* 2, a flower, *magnified. Fig.* 3, the calyx, *magnified.*

B. Portion of a branch of the var. *idonea.*

PLATE 62.—ILEX PARAGUAYENSIS.

A. Var. *dentata*, a portion of a branch in seed.

Fig. 1, a drupe, of the *nat. size. Fig.* 2, the same, *magnified. Fig.* 3, the same, viewed from above, showing the persistent stigma.

B. Var. *usitata,* portion of a branch in flower.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the calyx and ovary. *magnified.*

PLATE 63.—ILEX CURITIBENSIS. Portion of a branch.

Fig. 1, a drupe, *nat. size.* *Fig.* 2, the same, *magnified.*

PLATE 64.—ILEX.

A. Portion of a branch of ILEX GIGANTEA, in seed.

Fig. 1, a drupe, *nat. size.* *Fig.* 2, the same, *magnified.*

B. Portion of a branch of ILEX AMARA.

PLATE 65.—ILEX.

A. Portion of a flowering branch of ILEX HUMBOLDTIANA.

Fig. 1, a fertile flower. *Fig.* 2, the stamens, front and back view before dehiscence, and side view after dehiscence. *Fig.* 3, the ovary of a sterile flower: *all magnified.* *Fig.* 4, a berry, *nat. size.* *Fig.* 5, the same, *magnified.*

B. A small flowering branch of ILEX OVALIFOLIA.

Fig. 1, a fertile flower, *magnified.*

PLATE 66.—ILEX NIGROPUNCTATA.

Portions of a plant in flower and in seed.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the calyx. *Fig.* 3, the corolla. *Fig.* 4, the same, cut open. *Fig.* 5, the stamens. *Fig.* 6, a sterile ovary: *all equally magnified.* *Fig.* 7, a fertile flower, *magnified.*

PLATE 67.—VILLARESIA MUCRONATA.

A. Drawing of the typical plant.

Fig. 9, a fruit. *Fig.* 10, a longitudinal section of the same, showing the pseudo-parietal placentation resulting from the abortion of the other cells. *Fig.* 11, a transverse section of the same. *Fig.* 12, a seed, seen sideways. *Fig.* 13, a transverse section of the same, showing how it is moulded upon the placenta. *Fig.* 14, a longitudinal section of the same, showing the small embryo imbedded in the albumen: *all nat. size.* *Fig.* 15, the embryo, seen sideways and in front, *magnified.*

B. Drawing of the variety *læta.*

Fig. 1, a flower. *Fig.* 2, the petals: *both nat. size.* *Fig.* 3, the petals, *magnified.* *Fig.* 4, the stamens, *both magnified.* *Fig.* 5, a stamen, seen from before and behind, *more* *magnified.* *Fig.* 6, the ovary, seated on the calyx. *Fig.* 7, a longitudinal section of the same. *Fig.* 8, a transverse section of the same: *all equally magnified.*

PLATE 68.—Portion of a plant of VILLARESIA PUNGENS.

PLATE 69.—VILLARESIA CONGONHA.

Fig. 1, a three-flowered branch of the panicle. *Fig.* 2, a single flower: *both nat. size.* *Fig.* 3, a flower, *magnified.* *Fig.* 4, a sepal. *Fig.* 5, a petal. *Fig.* 6, the pistil, with the stamens. *Fig.* 7, the pistil: *all equally magnified.*

PLATE 70.—VILLARESIA CUSPIDATA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, a flower, *magnified.* *Fig.* 3, a sepal. *Fig.* 4, a petal, seen in front. *Fig.* 5, the same, seen sideways. *Fig.* 6, a stamen, seen in front and behind. *Fig.* 7, the ovary: *all equally magnified.* *Fig.* 8, longitudinal section of the same, with the ovules removed, to show the pseudo-parietal placenta. *Fig.* 9, the same, with the ovules in their place. *Fig.* 10, a transverse section of the same: *all more magnified.*

PLATE 71.—VILLARESIA MEGAPHYLLA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, the calyx. *Fig.* 3, the petals. *Fig.* 4, the stamens: *all magnified.* *Fig.* 5, the stamens, showing the filaments and anthers in different positions, *more magnified.* *Fig.* 6, the pistil. *Fig.* 7, a longitudinal section of the same, showing two collateral ovules in a single cell. *Fig.* 8, a transverse section of the same. *Fig.* 9, a two-celled ovary, with two collateral ovules in each cell. *Fig.* 10, a transverse section of the same: *all magnified.*

PLATE 72.—ÆXTOXICUM PUNCTATUM.

A. The male plant.

Fig. 1, a flower in bud, *nat: size.* *Fig.* 2, the same, showing how the bract bursts and falls off by the expansion of the bud, *magnified.* *Fig.* 3, the same, showing the mode of æstivation of the sepals and petals. *Fig.* 4, the same after expansion. *Fig.* 5, two of the sepals. *Fig.* 6, two of the petals. *Fig.* 7, the stamens: *all equally magnified.* *Fig.* 8, the stamens before and after dehiscence, *more magnified.* *Fig.* 9, the disk, *magnified.*

B. The female plant.

Fig. 10, a flower in bud, *nat. size.* *Fig.* 11, the same, showing the rupturing bract. *Fig.* 12, the same, showing the calyx and corolla in æstivation. *Fig.* 13, a sepal. *Fig.* 14, a petal. *Fig.* 15, the pistil, surrounded by the sterile stamens alternating with the lobes of the disk: *all equally magnified.* *Fig.* 16, two of the sterile stamens. *Fig.* 17, one of the free lobes of the disk: *both more magnified.* *Fig.* 18, longitudinal section of the ovary, seen sideways. *Fig.* 19, the same, seen in front. *Fig.* 20, a transverse section of the same: *all magnified.* *Fig.* 21, a fruit, *nat. size.* *Fig.* 22, a longitudinal section of the same, showing only a single fertilized seed. *Fig.* 23, the same, with two seeds perfected.

Fig. 24, a seed. *Fig.* 25, a longitudinal section of the same, showing the position of the embryo in the albumen. *Fig.* 26, the embryo removed: *all nat. size.* *Fig.* 27, the embryo, seen in front. *Fig.* 28, the same, seen sideways: *both magnified.*

PLATE 73.—BURSINOPETALUM.

A. Part of a branch of BURSINOPETALUM MACROPHYLLUM in fruit.

Fig. 1, a flowering panicle. *Fig.* 2, a single flower: *both nat. size.* *Fig.* 3, two of the petals. *Fig.* 4, a stamen: *both magnified.* *Fig.* 5, the stamens shown in different positions, *more magnified.* *Fig.* 6, the calyx. *Fig.* 7, longitudinal section of a flower, showing the positions of the petals, stamens, and ovary. *Fig.* 8, a longitudinal section of the ovary, showing it to be more than half superior: *all magnified.* *Fig.* 9, the style and stigma, *more magnified.*

B. Part of a fructiferous branch of BURSINOPETALUM ARBOREUM.

Fig. 10, a fruit, *nat. size.* *Figs.* 11 & 12, a transverse section of the same. *Fig.* 13, a seed, showing how it is moulded round the placenta, as in *Villaresia.* *Fig.* 14, a transverse section of the same. *Fig.* 15, a longitudinal section of the same, showing the embryo imbedded in albumen, as in *Villaresia*: *all nat. size.* *Fig.* 16, the embryo, *magnified.*

PLATE 74.—GOUPIA GLABRA.

Fig. 1, a flower, *nat. size.* *Fig.* 2, a flower in bud. *Fig.* 3, the petals with their apex inflected. *Fig.* 4, a flower after expansion: *all equally magnified.* *Fig.* 5, a flower with half of the calyx and of the disk cut away and the petals removed, to show the insertion of the stamens inside the large cup-shaped disk and round the ovary. *Fig.* 6, the stamens, seen placed inside the large cup-shaped disk. *Fig.* 7, the stamens, seen in different positions, showing the tuft of long hairs on the summit of the connective: *all magnified.* *Fig.* 8, two of the hairs, *more magnified.* *Fig.* 9, the ovary with its five styles. *Fig.* 10, a longitudinal section of the same, showing the insertion of the ovules. *Fig.* 11, a transverse section of the same: *all magnified.* *Fig.* 12, a drupaceous fruit. *Fig.* 13, a transverse section of the same. *Fig.* 14, a seed: *all nat. size.* *Fig.* 15, a seed covered by its fleshy arilline, showing the position of the hilum and raphe. *Fig.* 16, the testaceous second integument, crowned by the chalaza. *Fig.* 17, the albumen, covered by the third thin integument. *Fig.* 18, the embryo, imbedded in albumen. *Fig.* 19, the embryo, seen in front. *Fig.* 20, the same, seen sideways: *all equally magnified.*

PLATE 75.—EPHEDRA.

A. Portion of a plant of EPHEDRA CHILENSIS.

Fig. 1, a pair of opposite leaves combined into a vaginant sheath, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same where the sheath is ruptured by the growth of the stem. *Fig.* 4, a male spikelet, *nat. size.* *Fig.* 5, the same, *magnified.*

B. Portions of male and female plants of EPHEDRA BRACTEATA.

Fig. 1, a pair of connate leaflets, *nat. size.* *Fig.* 2, the same, *magnified.* *Fig.* 3, the same, ruptured by age. *Fig.* 4, a male spikelet: *all nat. size. Fig.* 5, the same, *magnified. Fig.* 6, a perigonium surrounding the antheriferous column, seen in front. *Fig.* 7, the same, seen sideways: *all magnified. Fig.* 8, a female spikelet, *nat. size. Fig.* 9, the same, *magnified. Fig.* 10, a pair of involucels. *Fig.* 11, two apical fruits, seen in front. *Fig.* 12, the same, seen sideways: *all magnified. Fig.* 13, a fruit, *more magnified.*

Plate 76.—Ephedra.

A. Portions of male and female plants of Ephedra monticola.

B. Part of a male plant of Ephedra Andina.

Fig. 1, a pair of connate leaflets. *Fig.* 2, the same, ruptured by age: *nat. size. Fig.* 3, a flower enclosed in its involucel, seen in front. *Fig.* 4, a pair of opposite flowers enclosed in their connate involucels, seen sideways. *Fig.* 5, a perigonium, enclosing its antheriferous column, seen in front. *Fig.* 6, the same, seen sideways: *all magnified. Fig.* 7, an anther, showing its two apical pores. *Fig.* 8, a transverse section of the same, to show its two cells: *both more magnified, Fig.* 9, a grain of pollen, seen sideways. *Fig.* 10, the same, seen from above: *both highly magnified.*

Plate 77.—Ephedra.

A. Portion of a female plant of Ephedra dumosa.

Fig. 1, a pair of connate leaflets, *magnified. Fig.* 2, a terminal pair of achenia, one of them with its exserted tubillus. *Fig.* 3, an achenium seen sideways, showing the open pore at its summit. *Fig.* 4, a longitudinal section of the pericarp of the same, showing the enclosed seed with its tubillus passing through the apical pore. *Fig.* 5, a longitudinal section of the same, showing the albumen enclosed within the two integuments, which are agglutinated below, free above, and united again in the summit upon a red fleshy gland that supports the tubillus, which is a tubular extension of the outer coating. *Fig.* 6, the albumen. *Fig.* 7, a longitudinal section of the same, enclosing the embryo, as seen on its face. *Fig.* 8, the same, with the enclosed embryo seen on its edge, and showing the expansibility of the cellular apex of the albumen: *all equally magnified. Fig.* 9, the reticulated texture of the involucels, enclosing a stratum of elongated spicular fibres, *highly magnified.*

B. Portion of a male plant of Ephedra ochreata.

Fig. 1, three ternate leaflets, united into a vaginant tube. *Fig.* 2, the same, splitting by age, *nat. size. Fig.* 3, a trilobed involucel. *Fig.* 4, the same, seen from above, containing its three verticillate flowers. *Fig.* 5, a perigonium. *Fig.* 6, the same, enclosing its antheriferous column: *all magnified.*

Plate 78.—Ephedra.

A. Portions of male and female plants of Ephedra Americana.

Fig. 1, a pair of leaflets. *Fig.* 2, the same, split open by age. *Fig.* 3, a male spikelet: *all nat. size. Fig.* 4, the same, *magnified. Fig.* 5, a perigonium enclosing its antheriferous column. *Fig.* 6, the column supporting its anthers: *all more or less magnified.* *Fig.* 7, a female spikelet. *Figs.* 8 & 9, the two terminal achenia, with their tubillus exserted: *nat. size.* *Fig.* 10, a longitudinal section of the achenium, enclosing the seed with its integuments, gland, and tubillus. *Fig.* 11, the same, with the pericarp removed. *Fig.* 12, the albumen. *Fig.* 13, a longitudinal section of the same, showing the enclosed embryo. *Fig.* 14, the embryo, seen on its edge: *all equally magnified.*

B. Portion of a male plant of EPHEDRA TWEEDIANA.

Fig. 1, a pair of leaflets. *Fig.* 2, the same, split open by age: *nat. size.* *Fig.* 3, a pair of involucels. *Fig.* 4, a portion of an involucel enclosing the spicular fibres. *Fig.* 5, one of these fibres. *Fig.* 6, a perigonium enclosing the antheriferous column. *Fig.* 7, the antheriferous column: *all more or less magnified.* *Fig.* 8, a female spikelet. *Fig.* 9, the terminal pair of achenia, each with its exserted tubillus. *Fig.* 10, the two achenia separated: *all nat. size.* *Fig.* 11, the two achenia, *magnified.* *Fig.* 12, one of the achenia, seen edgewise. *Fig.* 13, half of the pericarp removed, to show the enclosed seed surmounted by its exserted tubillus. *Fig.* 14, the seed, removed. *Fig.* 15, half of the two integuments, removed, which are agglutinated in their lower moiety, free and corrugated above, and then again united upon the apical gland which supports the tubillus. *Fig.* 16, the albumen, removed. *Fig.* 17, longitudinal section of the same, showing the enclosed embryo. *Fig.* 18, the embryo, removed, seen on its edge: *all equally magnified.* *Fig.* 19, the mode of germination of the seed of *Ephedra Tweediana*, where the pericarp splits to allow the exit of the growing seed (copied from Prof. Meyer's drawing). *Fig.* 20, the growing seed, deprived of its pericarpial covering, showing the splitting of the albumen and the expansion of the radicle and cotyledons, the integuments being still surmounted by the persistent gland and tubillus: *much magnified.*

PLATE 79.—EPHEDRA.

A. Portions of the male and female plants of EPHEDRA SCANDENS.

Fig. 1, a male spikelet. *Fig.* 2, a female spikelet. *Fig.* 3, the lower pair of involucels, upon the pedicel. *Fig.* 4, the second pair. *Fig.* 5, the third pair. *Fig.* 6, the fourth or terminal pair, which enclose the two achenia. *Fig.* 7, the two achenia separated: *all nat. size.* *Fig.* 8, the two achenia with their exserted tubillus, *magnified.* *Fig.* 9, one of the same, seen sidewise.

B. A portion of a male plant of EPHEDRA FRUSTILLATA.

Fig. 1, a pair of leaflets. *Fig.* 2, a male spikelet on its pedicel: *both nat. size.*

PLATE 80.—ARISTOTELIA MAQUI.

Fig. 1, a flower. *Fig.* 2, the calyx. *Fig.* 3, a petal. *Fig.* 4, some of the stamens: *all natural size.* *Fig.* 5, a petal. *Fig.* 6, the same, seen sidewise. *Fig.* 7, a stamen: *all magnified on the same scale.* *Fig.* 8, a stamen, seen in front. *Fig.* 9, the same, seen sidewise: *more magnified.* *Fig.* 10, the pistil seated within the disk. *Fig.* 11, the same, seen from above, showing the cicatrices formed by the insertion of the stamens. *Fig.* 12, a longitudinal section of the same. *Fig.* 13, a transverse section of the same: *all magnified on the same scale.* *Figs.* 14 & 15, two ovules, or a solitary ovule in each cell, *still more magnified.* *Fig.* 16, a fruit. *Fig.* 17, a vertical section of the same.

Fig. 18, a transverse section. *Fig.* 19, two seeds from one cell: *all nat. size.* *Fig.* 20, a seed, shown sidewise. *Fig.* 21, the same, seen on the dorsal side. *Fig.* 22, the same, with half of the external covering (arilline) removed, to show the intermediate osseous coating (testa). *Fig.* 23, a transverse section of a seed. *Fig.* 24, the osseous testa, with the raphe and chalaza (which has a cavity) in the base. *Fig.* 25, a longitudinal section of the same, with the albumen and inner integument removed, showing the hollow space in the thick basal chalaza in which the raphe terminates. *Fig.* 26, the third or inner integument of the seed. *Fig.* 27, a longitudinal section of the albumen, enclosing the embryo. *Figs.* 28 & 29, the embryo, seen on one face and edgewise: *all magnified on the same scale.*

PLATE 81.—VALLEA PUBESCENS.

Fig. 1, a flower in bud. *Fig.* 2, the same, expanded. *Fig.* 3, a petal. *Fig.* 4, a stamen. *Fig.* 5, the pistil: *all nat. size.* *Fig.* 6, a sepal. *Fig.* 7, a petal. *Fig.* 8, a stamen. *Fig.* 9, the pistil, seated on the disk within the calyx. *Fig.* 10, a longitudinal section of the ovary and disk, showing the insertion of the stamens round the middle of the disk: *all magnified.* *Fig.* 11, a fruit, *nat. size.* *Fig.* 12, a longitudinal section of the same, showing the membranaceous epicarp corrugated into many obtuse tubercles replete with the fleshy mesocarp; also denoting the mode of attachment of the seeds. *Fig.* 13, a transverse section of the same: *both magnified.*

PLATE 82.—TRICUSPIDARIA PATAGUA.

Fig. 1, the calyx, in bud. *Fig.* 2, the same, after the expansion of the flower. *Fig.* 3, the same, seen from below. *Fig.* 4, a petal, on its inner face. *Fig.* 5, the same, seen externally. *Fig.* 6, a flower with the petals removed, to show the insertion of the stamens on the disk. *Fig.* 7, three of the stamens. *Fig.* 8, the pistil seated on the disk: *all nat. size.* *Fig.* 9, a longitudinal section of the ovary, together with the mode of insertion of the stamens upon the disk, *magnified.* *Fig.* 10, a fruit in dehiscence, seen from above. *Fig.* 11, the same, with some of the seeds removed, showing its loculicidal dehiscence, the dissepiments remaining attached along the middle of the valves. *Fig.* 12, a seed: *all nat. size.* *Fig.* 13, a seed, *magnified.* *Fig.* 14, a transverse section of the same, showing the external fleshy covering, the intermediate osseous coating, the inner thin integument, the albumen and embryo. *Fig.* 15, the seed, with half of its fleshy external covering removed, showing the intermediate osseous coating, with its large truncated basal chalaza. *Fig.* 16, the osseous coating, showing the line of raphe in front. *Fig.* 17, the same, seen sideways. *Fig.* 18, a longitudinal section of the osseous coating, showing the hollow space within the very thick chalaza. *Fig.* 19, the albumen extracted, covered by the thin inner integument. *Fig.* 20, a longitudinal section of the same. *Fig.* 21, the embryo extracted, seen on its face. *Fig.* 22, the same, seen edgewise: *all magnified on the same scale.*

PLATE 83.

A. Portion of a branch of CRINODENDRON HOOKERIANUM.

Fig. 1, a flower. *Fig.* 2, the calyx. *Fig.* 3, a petal, seen behind and before. *Fig.* 4, the pistil, seated on the disk and calyx, with one of the stamens, to show the place of their insertion: *all nat. size.* *Fig.* 5, a stamen, seen in front and sidewise. *Fig.* 6, a longitudinal section of the ovary seated on the disk: *both magnified.* *Fig.* 7, the unripe fruit, as observed by Sir Wm. Hooker, *nat. size.*

B. A branch of Cortesia cuneata.

Fig. 1, a flower. *Fig.* 2, the calyx. *Fig.* 3, the corolla: *all nat. size.* *Fig.* 4, the calyx cut open, to show the position of the appendages between the calyx and corolla. *Fig.* 5, the corolla. *Fig.* 6, the same, cut open, to show the insertion of the stamens. *Fig.* 7, two of the stamens, showing the mode of attachment of the anthers. *Fig.* 8, the stipitated pistil: *all equally magnified.* *Fig.* 9, a transverse section of the ovary, showing its peculiar organization, the position of the ovules, the pseudo-dissepiments, and the central columella, *more magnified.* *Fig.* 10, a fruit, half invested by the persistent calyx. *Fig.* 11, the same, with the calyx taken away. *Fig.* 12, the same, with half of the pericarp removed, to show the two included nucules. *Fig.* 13, the two nucules, seen separately. *Figs.* 14 & 15, the same, shown on their two faces: *all nat. size.* *Fig.* 16, a nucule, seen on its inner face. *Fig.* 17, a transverse section of the same below the summit, showing the inflected plates and the openings into the cells for the communication of the nourishing vessels from the columella to the funicles of the seeds. *Fig.* 18, the upper halves of the two nucules cut away, leaving one of the seeds in its cell, showing the funicular point of its attachment below the summit. *Fig.* 19, a seed, with its funicle and raphe on the ventral side. *Fig.* 20, the same, seen sidewise. *Fig.* 21, a longitudinal section of the same, showing the embryo enclosed in thin albumen. *Fig.* 22, the embryo, seen on its face. *Fig.* 23, the same, seen on its edge, showing the relative size of its two cotyledons. *Fig.* 24, the same, with three cotyledons, as sometimes occurs: *all magnified on the same scale.*

Plate 84.—Rhabdia crebrifolia.

Fig. 1, a nascent branch, concealed within the imbricated leaves, with its few terminal alternate flowers. *Fig.* 2, a flower, with two bracts on the pedicel. *Fig.* 3, the calyx. *Fig.* 4, the corolla. *Fig.* 5, a stamen. *Fig.* 6, the pistil: *all nat. size.* *Fig.* 7, the calyx, expanded. *Fig.* 8, the corolla, expanded. *Fig.* 9, the same, cut open, to show the position of the stamens: *all magnified.* *Fig.* 10, the stamens, showing the mode of attachment of the anthers and their manner of dehiscence. *Fig.* 11, the stipitate pistil, without any disk. *Fig.* 12, a transverse section of the same, showing the four cells and central columella: *all more magnified.* *Fig.* 13, the fruit enclosed in the persistent calyx. *Fig.* 14, the fruit removed: *both nat. size.* *Fig.* 15, the same, *magnified.* *Fig.* 16, a transverse section of the same, showing four nucules enclosed within the pericarp, around the central columella. *Fig.* 17, the four nucules seen from above. *Fig.* 18, the same, separated, attached bigeminately. *Fig.* 19, a transverse section of the four nucules around the columella. *Fig.* 20, a transverse section of the four nucules separated, with the seeds removed, showing the relative position of the apertures leading into the cells. *Fig.* 21, the nucules, attached in pairs by a fungous longitudinal line, which is a portion of the columella. *Fig.* 22, the same, separated, showing the placentary fungous line by which they are attached to the columella. *Fig.* 23, the central hollow membranaceous columella. *Fig.* 24, a transverse section of the same, showing the branches of nourishing vessels that penetrate the cells, in conjunction with the funicles of the seeds. *Fig.* 25, a nucule, with half of the putamen removed, exhibiting the seed attached below the summit. *Fig.* 26, the seed, with its funicle and raphe, seen laterally. *Fig.* 27, the same, seen on the ventral face. *Fig.* 28, the same, with the outer integument removed. *Fig.* 29, the embryo enclosed in albumen. *Fig.* 30, the embryo separated, seen on its face. *Fig.* 31, the same, seen sidewise: *all equally magnified.*

Plate 85.—Ehretia elliptica.

Fig. 1, the calyx, with the enclosed pistil. *Fig.* 2, the corolla expanded. *Fig.* 3, the same, cut open, showing the position of the stamens: *all magnified.* *Fig.* 4, a stamen, to show the mode of insertion of the filaments and of attachment of the anthers: *more magnified.* *Fig.* 5, the pistil, seated on a small disk, *magnified as in Fig.* 3. *Fig.* 6, a transverse section of the same, showing the development of the cells, the position of the ovules, and central columella, *more magnified.* *Fig.* 7, the fruit, in the persistent calyx, *nat. size.* *Fig.* 8, a transverse section of the same, showing two bilocular nucules enclosed within the pericarp. *Fig.* 9, external view of one of the nucules. *Fig.* 10, inner view of the same, partly hidden by the columella. *Fig.* 11, the membranaceous central columella. *Fig.* 12, transverse section of the same, with its cords of nourishing vessels passing through the apertures into the cells. *Fig.* 13, a transverse section of a nucule below the summit, showing the channels for the nourishing vessels leading to the funicles of the seeds. *Fig.* 14, another transverse section, across the middle, where the cells are entire. *Fig.* 15, a longitudinal section of the nucule in the line of the aperture leading into the cell. *Fig.* 16, a seed extracted. *Figs.* 17 & 18, the embryo, shown in front and sidewise: *all magnified.* *Figs.* 19 & 20, the same, *more magnified.*

Plate 86.—Bourreria Havanensis.

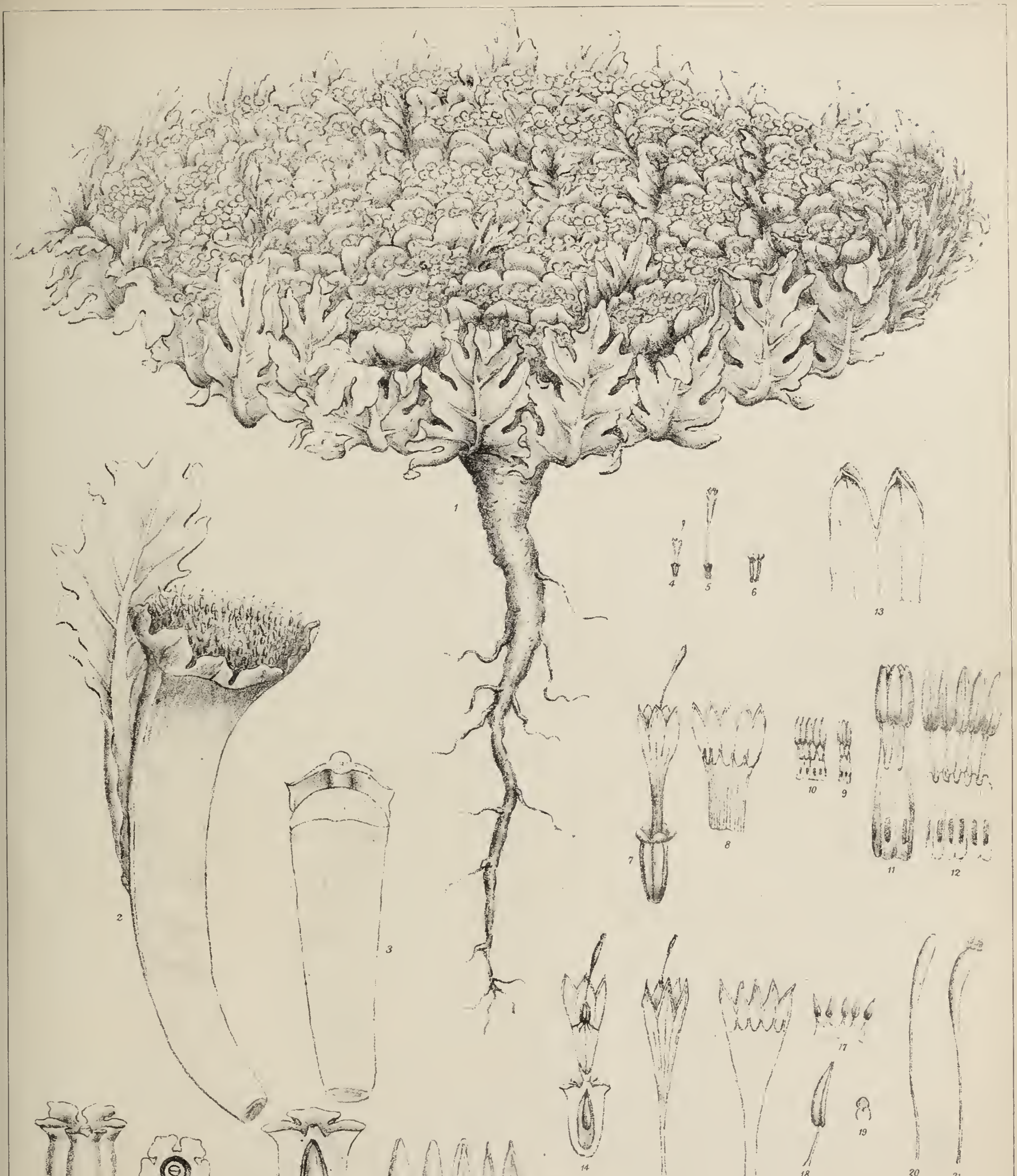
Fig. 1, the calyx. *Fig.* 2, the corolla cut open: *both magnified.* *Fig.* 3, a stamen, seen before and behind, *more magnified.* *Fig.* 4, the calyx cut open, showing the pistil seated on its small disk, *magnified.* *Fig.* 5, a transverse section of the ovary, showing the mode of placentation from the central columella, *more magnified.* *Fig.* 6, a fruit in the persistent calyx. *Fig.* 7, the pericarp cut longitudinally, to show two of the enclosed nucules. *Fig.* 8, two of the bigeminate nucules separated, seen on the ventral angle, showing the spurious cells into which the placentary vessels from the columella are received. *Figs.* 9 & 10, a lateral and dorsal view of the same: *all nat. size.* *Fig.* 11, a dorsal view of a nucule, showing the oblique lines of reticulated cells with which it is there covered. *Fig.* 12, a ventral view of the same, showing the position of the open vacuity. *Figs.* 13 & 14, lateral views of the same, upon its two angular sides. *Fig.* 15, a transverse section of the four nucules, showing the pseudo-cells filled with placentary matter, by which they adhere in pairs and are there attached to the central columella. *Fig.* 16, the central columella, with its bundles of vessels leading into the pseudo-cells. *Fig.* 17, a nucule, seen from above, showing its peculiar dorsal cellules arranged in oblique longitudinal lines. *Fig.* 18, a transverse section of the same, showing the dorsal rigid cellules and the seminiferous cell and placentary vacuity placed within the osseous portion. *Fig.* 19, a longitudinal section of the same, showing the small channel leading from the summit of the pseudo-cell into the real cell, where the seed is attached by its funicle. *Fig.* 20, a seed, seen laterally, with its funicle and raphe. *Fig.* 21, a view of the same, on its ventral face. *Fig.* 22, the embryo, enclosed in albumen. *Figs.* 23 & 24, the embryo, seen sidewise and on its face: *all equally magnified.*

Plate 87.—Crematomia Guildingiana.

Fig. 1, the calyx. *Fig.* 2, the corolla. *Fig.* 3, the same, cut open, to show the auriculated lobes of its border and the position of the stamens: *all nat. size.* *Fig.* 4, a stamen. *Fig.* 5, an anther, seen before and behind: *both magnified.* *Fig.* 6, the calyx, cut open, to show the pistil, *nat. size*. *Fig.* 7, a transverse section of the ovary, to show the peculiar mode of placentation and the central columella, *magnified*. *Fig.* 8, a fruit from which the fleshy pericarp has fallen away, *nat. size*. *Fig.* 9, the persistent calyx, with the four carpophora or rigid portions of the columella from which the four achenia have fallen away. *Fig.* 10, the four achenia bigeminately attached in pairs, as seen from above, with the four central carpophora from which they are suspended. *Fig.* 11, one of the achenia, seen on its ventral face: *all nat. size*. *Fig.* 12, the same, with the deflected portion of its carpophorum, showing the lateral channel leading into the cell, *magnified*. *Fig.* 13, the same, viewed sidewise. *Fig.* 14, the same, seen on its dorsal face. *Fig.* 15, a transverse section of the same, showing the small osseous portion in the ventral angle, with the lateral channel leading into the cell; the major portion, consisting of long, transverse, centripetal cells, is seen to form its dorsal substance. *Fig.* 16, the central columella, which withers into four rigid carpophora, from the summit of which one of the achenia is suspended. *Fig.* 17, a longitudinal section of the same across the ventral angle, showing the small nucumentaceous portion, with the aperture leading into the cell. *Fig.* 18, a seed, with its funicle and raphe: *all equally magnified*.

CREMATOMIA CALOPHYLLA.

Fig. 19, the ripe drupaceous fruit. *Fig.* 20, the same, with half of its fleshy pericarp removed, showing two of the enclosed achenia. *Figs.* 21 & 22, an achenium, seen on its side and ventral face. *Fig.* 23, a transverse section of the same. *Fig.* 24, the persistent calyx and columella, where the carpophora are enveloped by fleshy matter: *all nat. size*, and taken from actual observation.

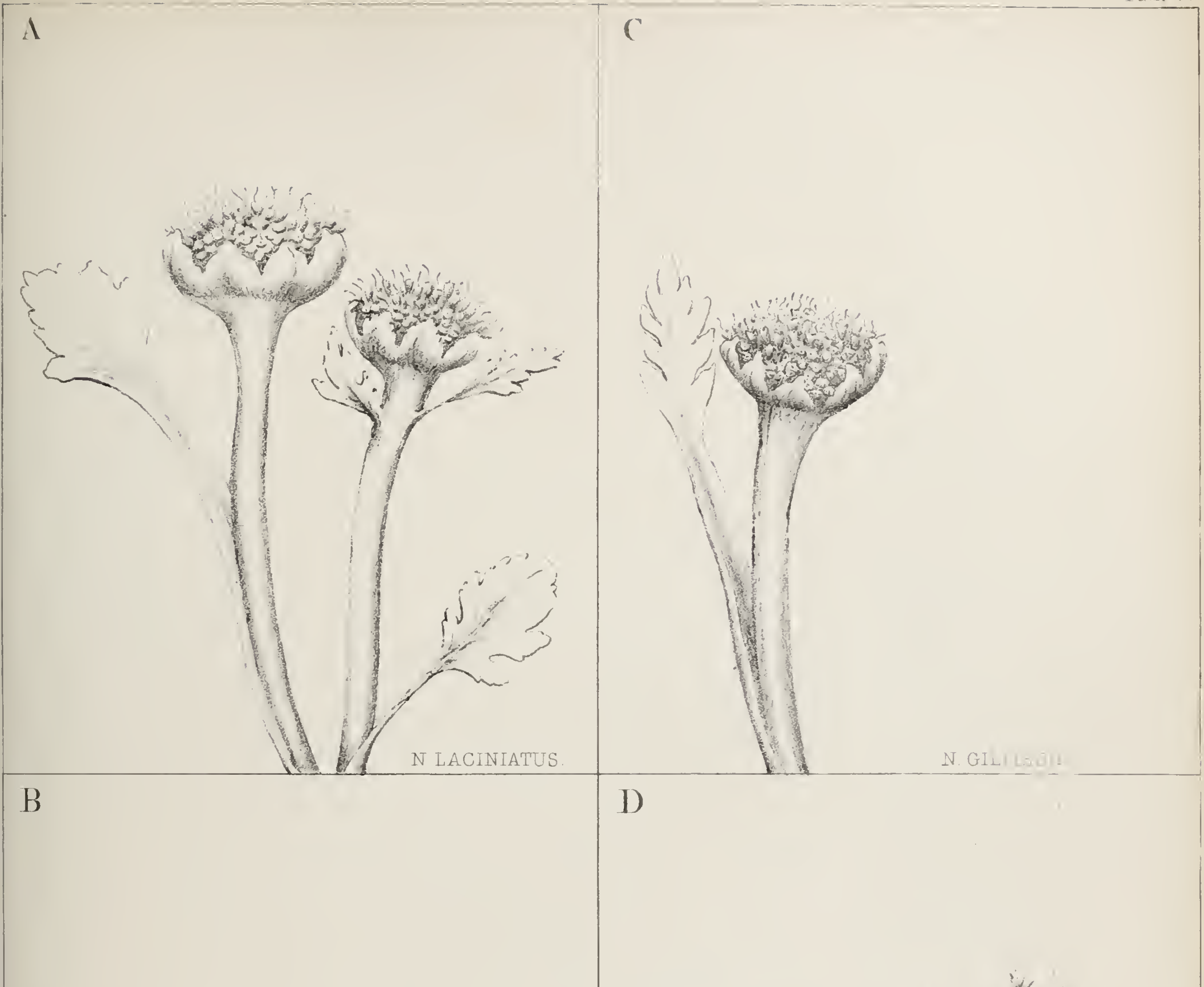


J. Miers del

W West imp

NASTANTHUS AGGLOMERATUS.

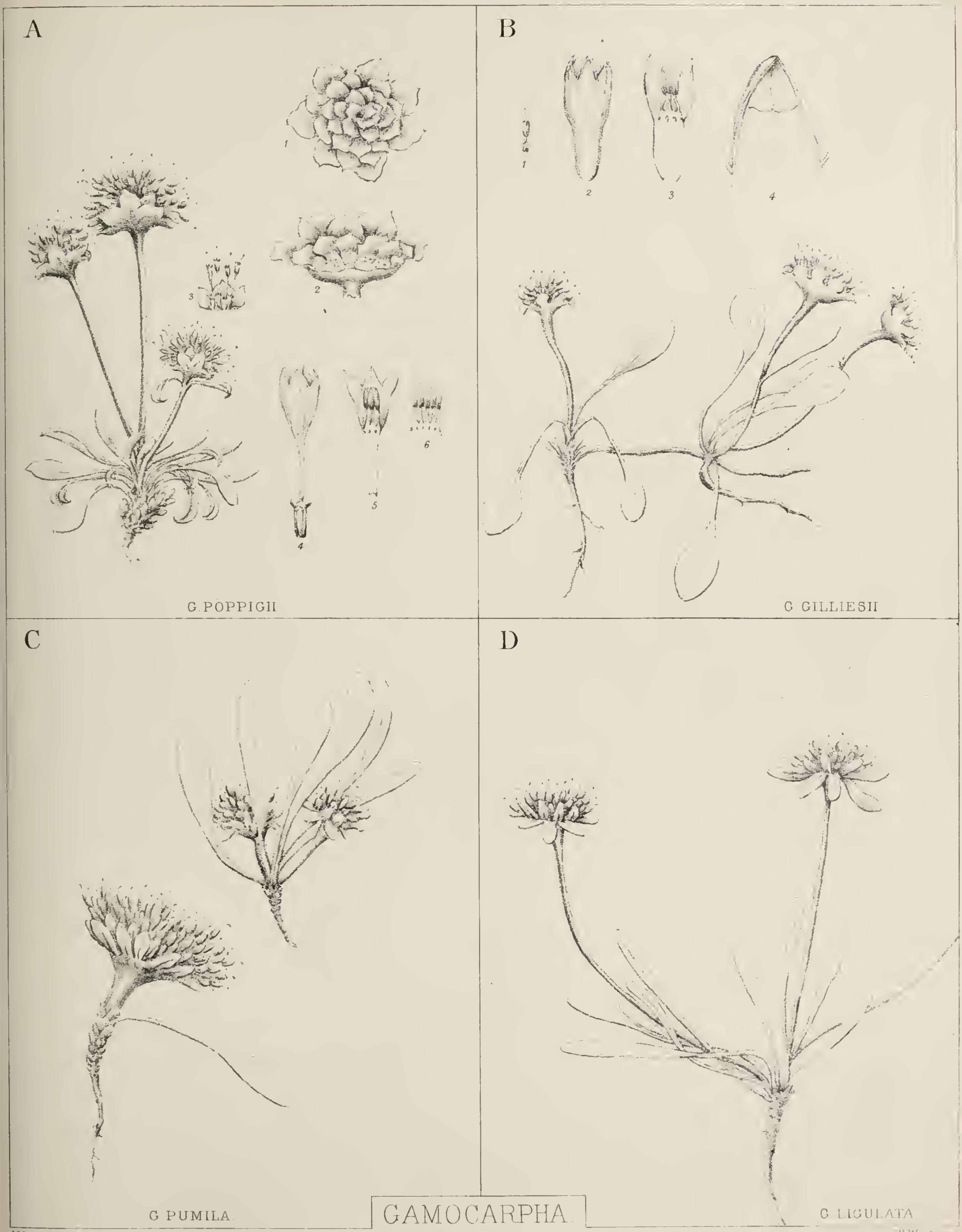
Plate 44


A
N. LACINIATUS.
C
N. GILLIESII.
B
N. PINNATIFIDUS.
D
N. SCAPIGERUS.

NASTANTHUS.

J Miers del

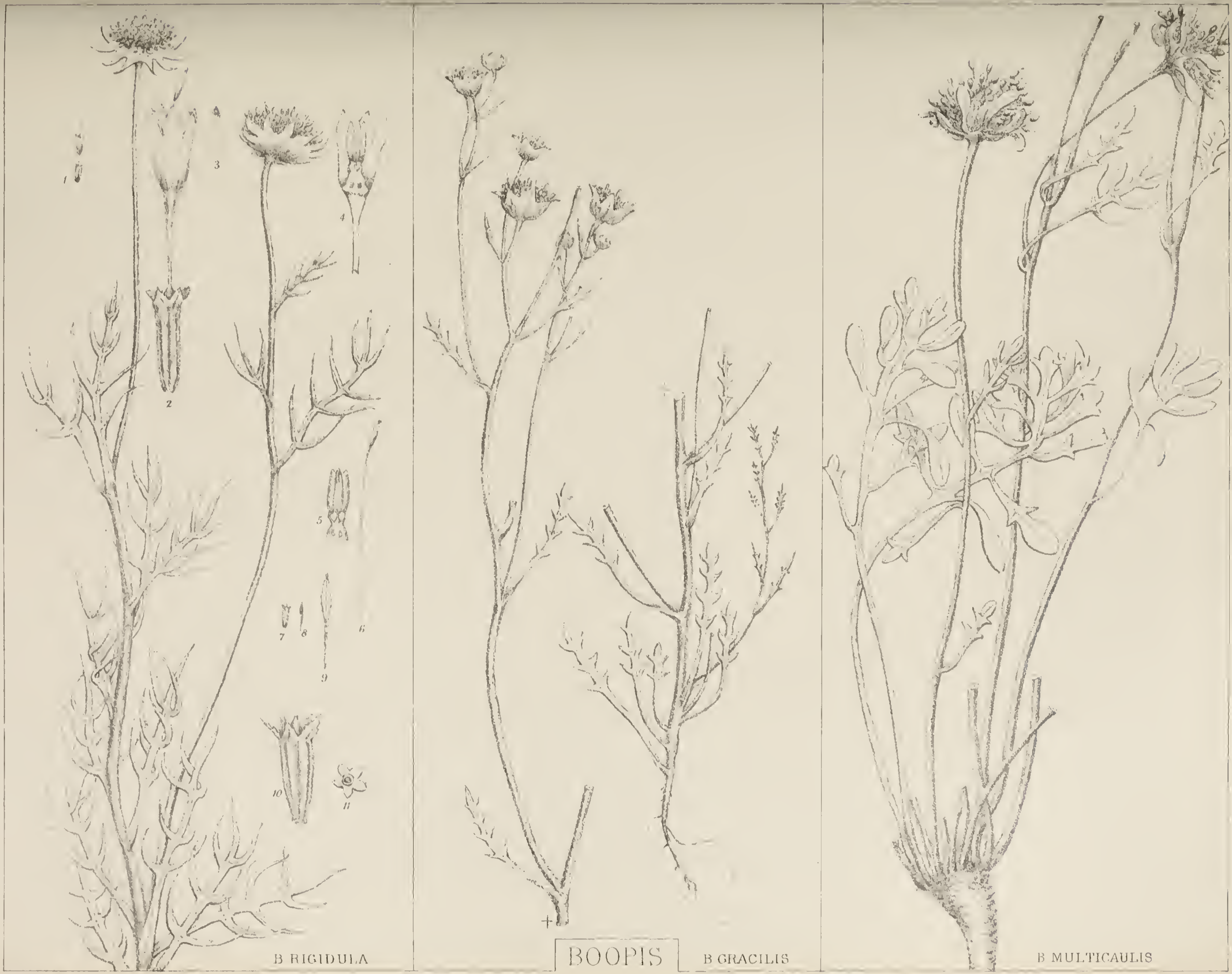
W West imp



GAMOCARPHA

J. Miers, del
W. West, imp

Plate 46



B RIGIDULA

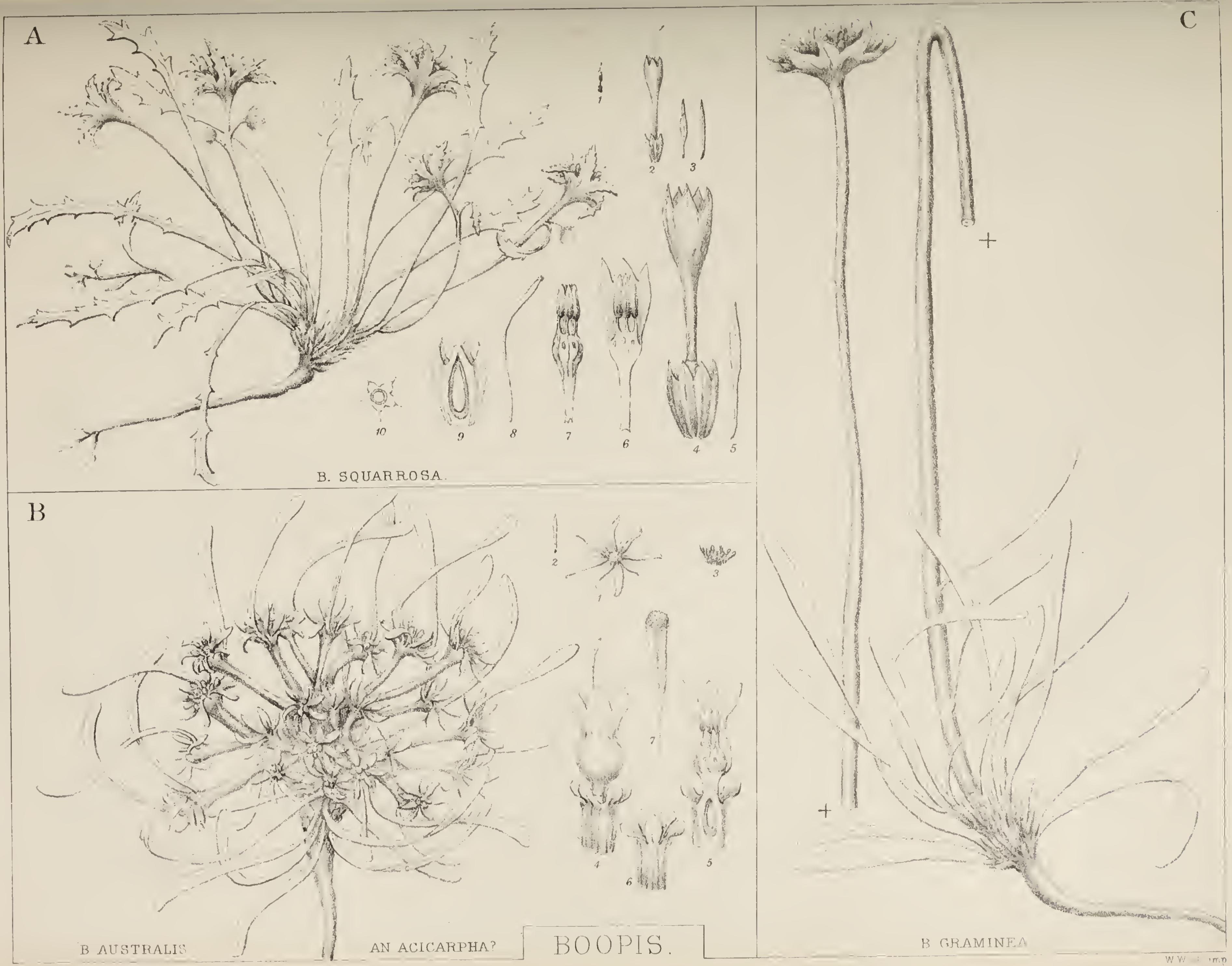
BOOPIS

B GRACILIS

B MULTICAULIS

J Miers del

W West imp



B. SQUARROSA.

B AUSTRALIS AN ACICARPHA?

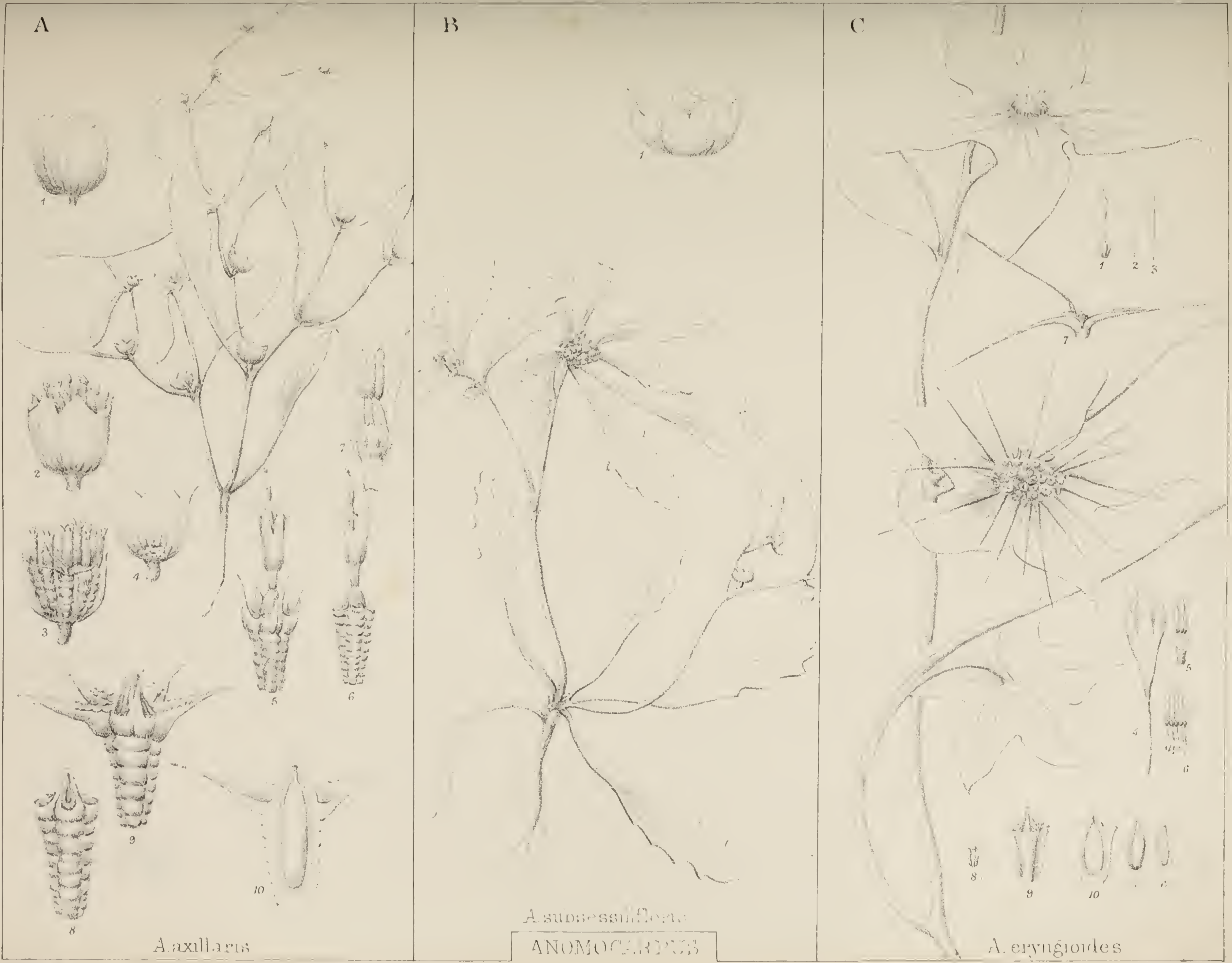
B GRAMINEA

BOOPIS.

J Miers del

W W [illegible] imp

Plate 48



A. axillaris

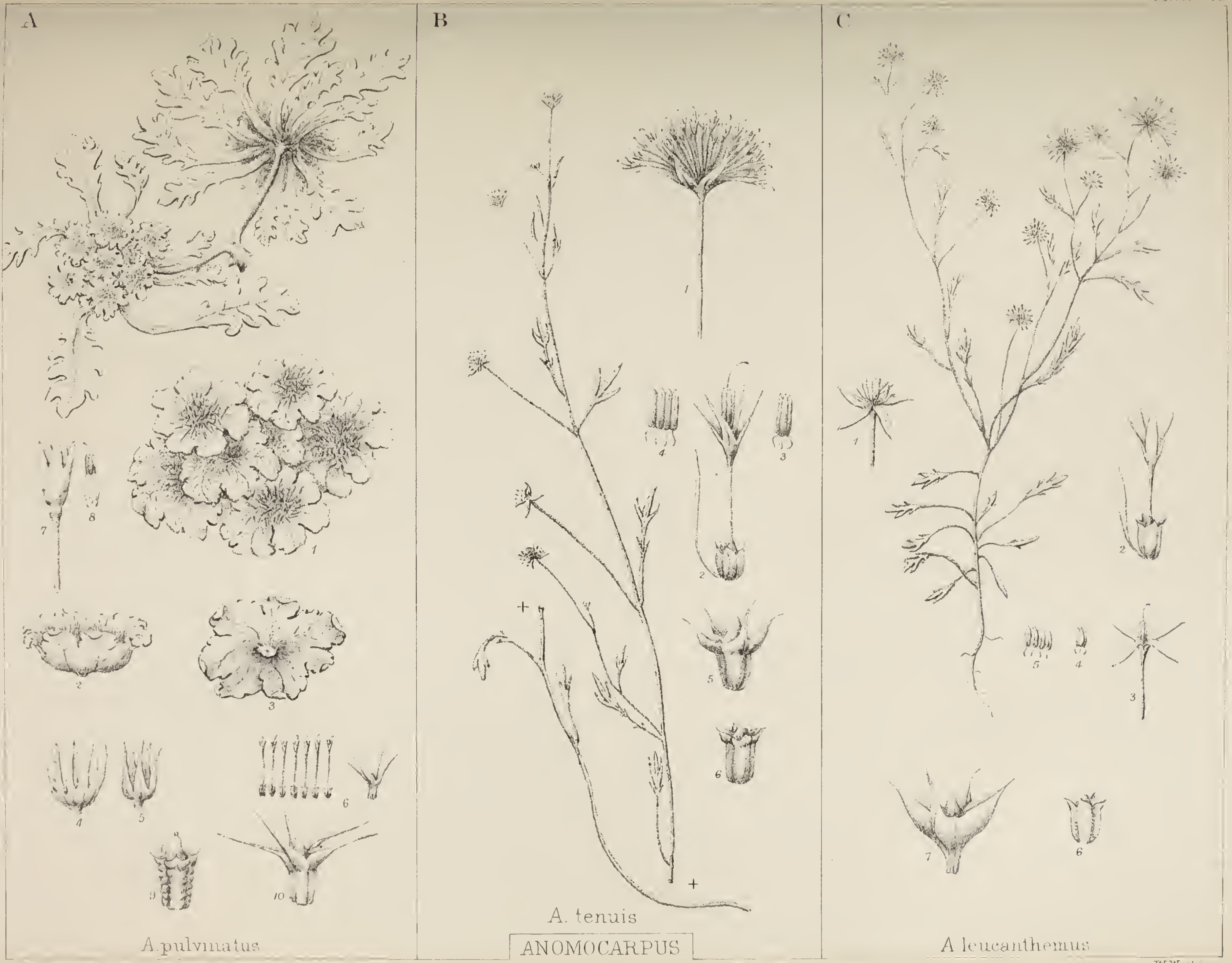
A. subsessiliflora

ANOMOCARPUS

A. eryngioides

J. Miers del.

W. West imp.



A. pulvinatus

A. tenuis

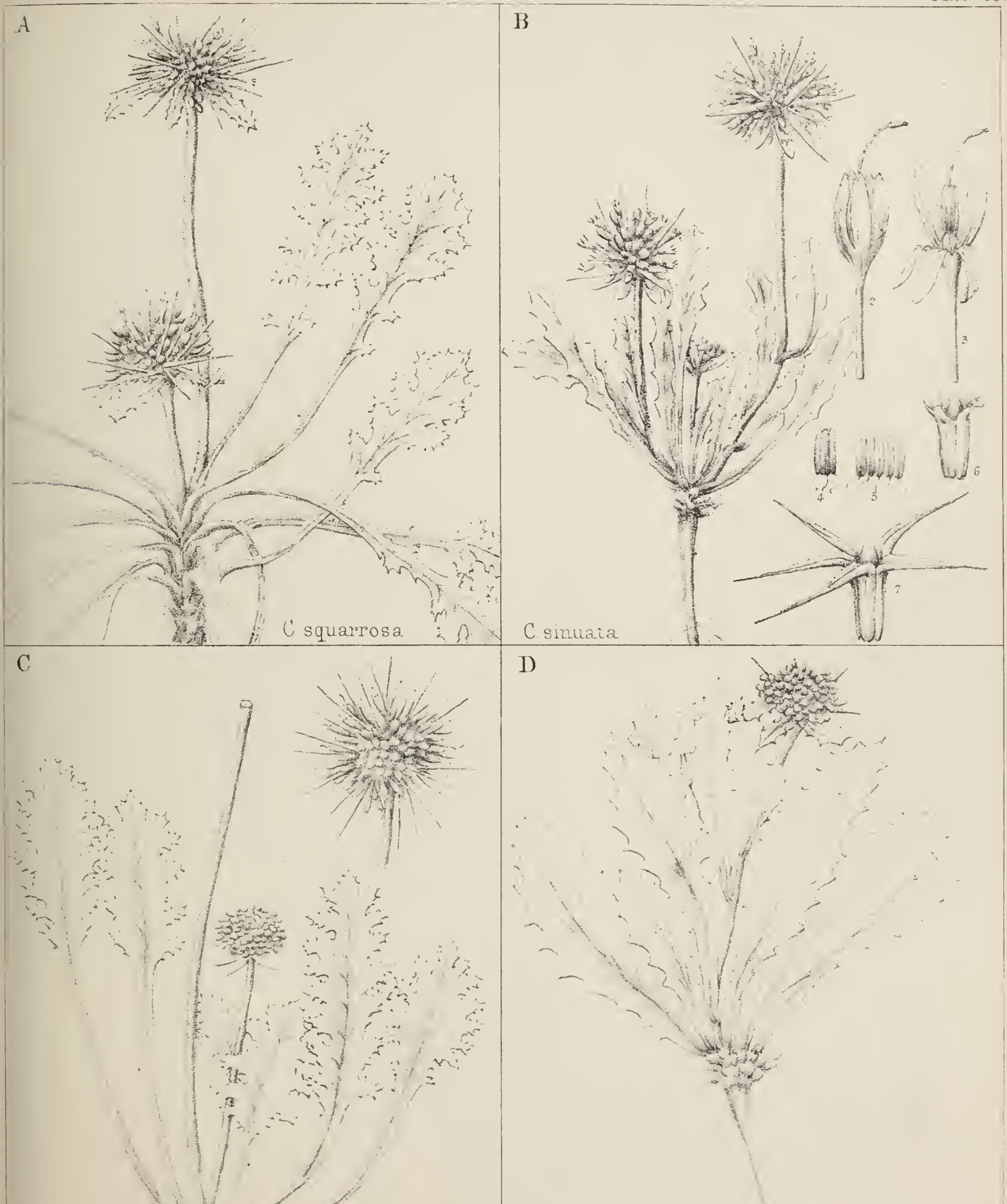
A leucanthemus

ANOMOCARPUS

J Miers del

W West imp.

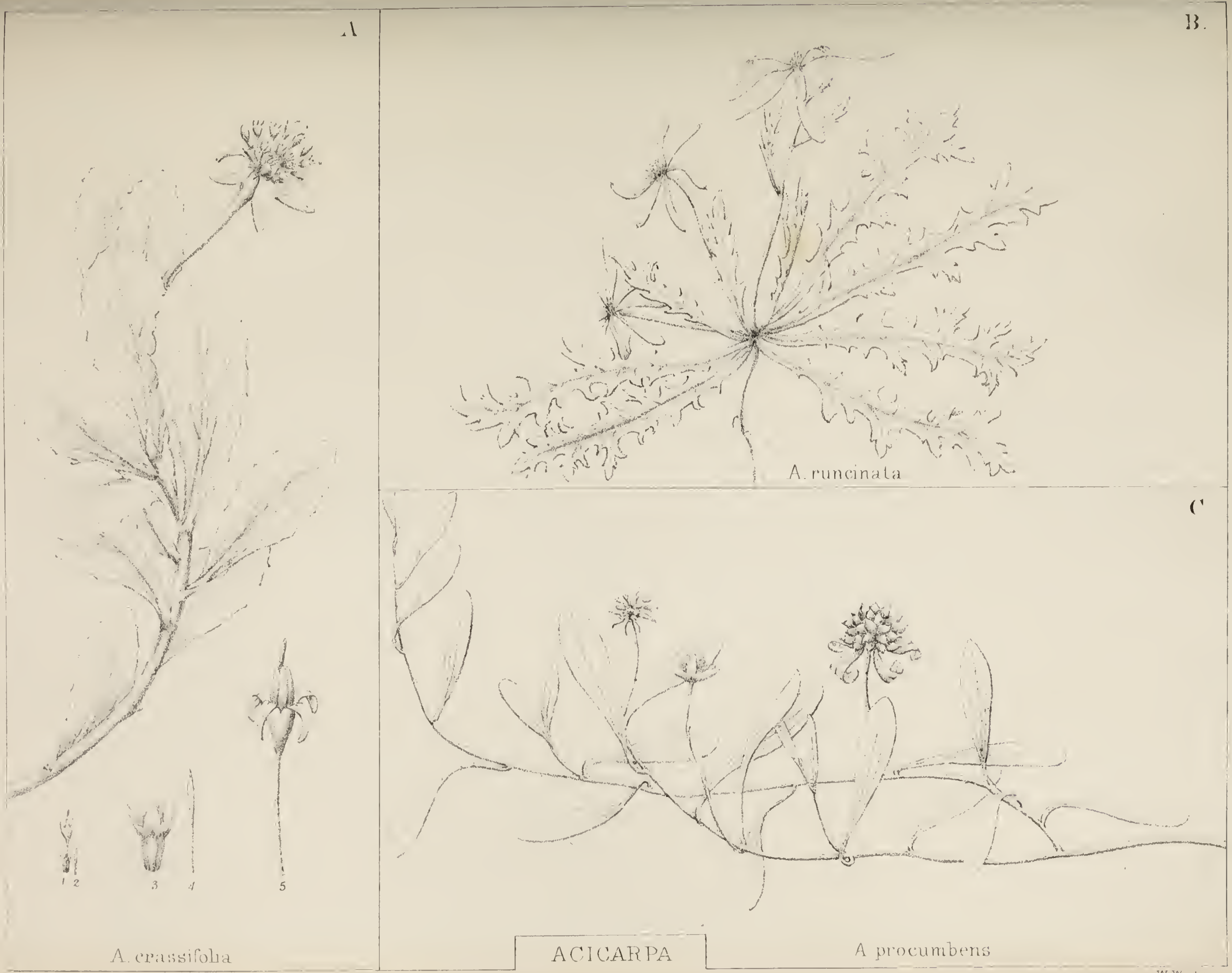
Plate 50.



CALYCERA

Miers ac

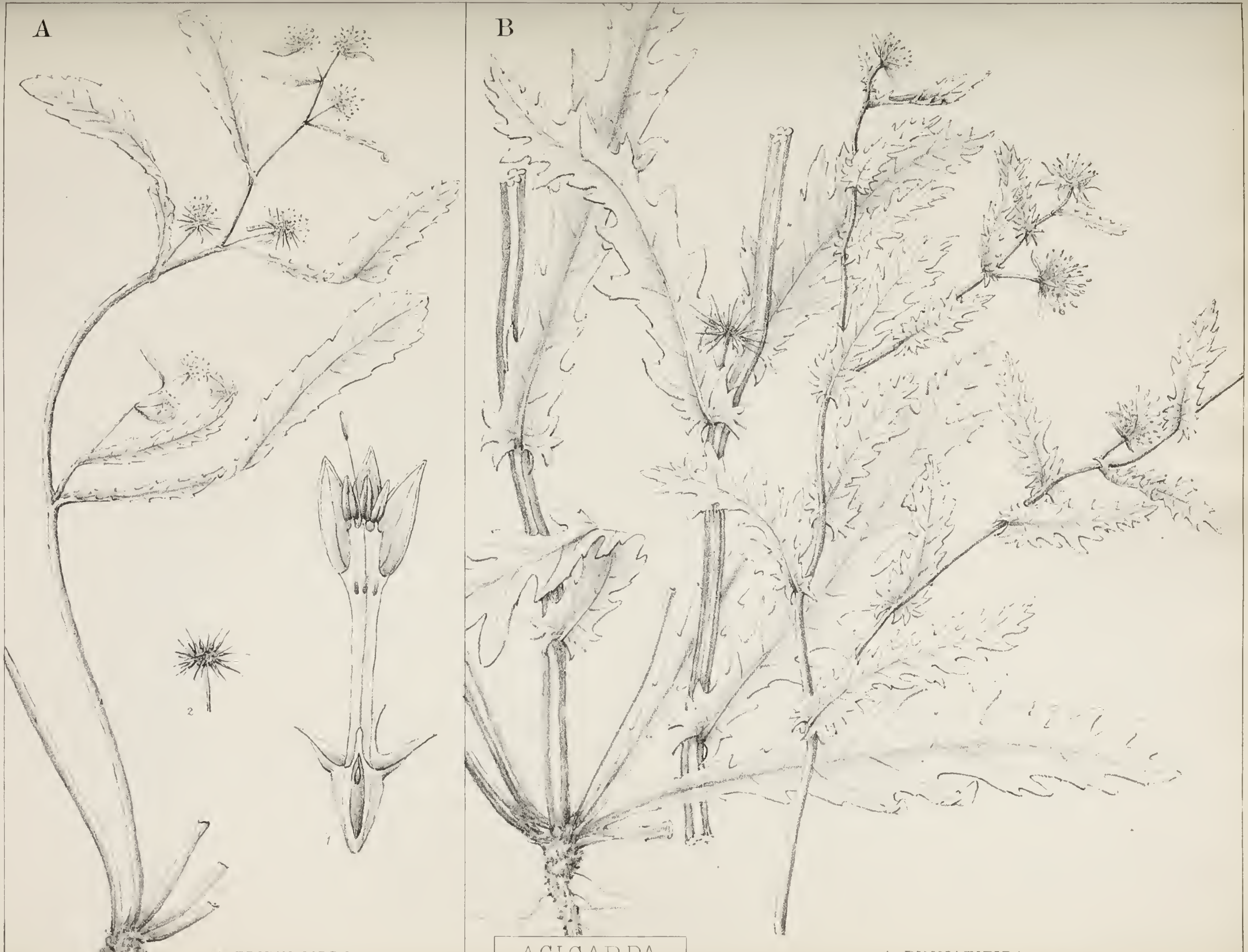
W. [illegible] imp



ACICARPA

J. Miers del

W. West imp



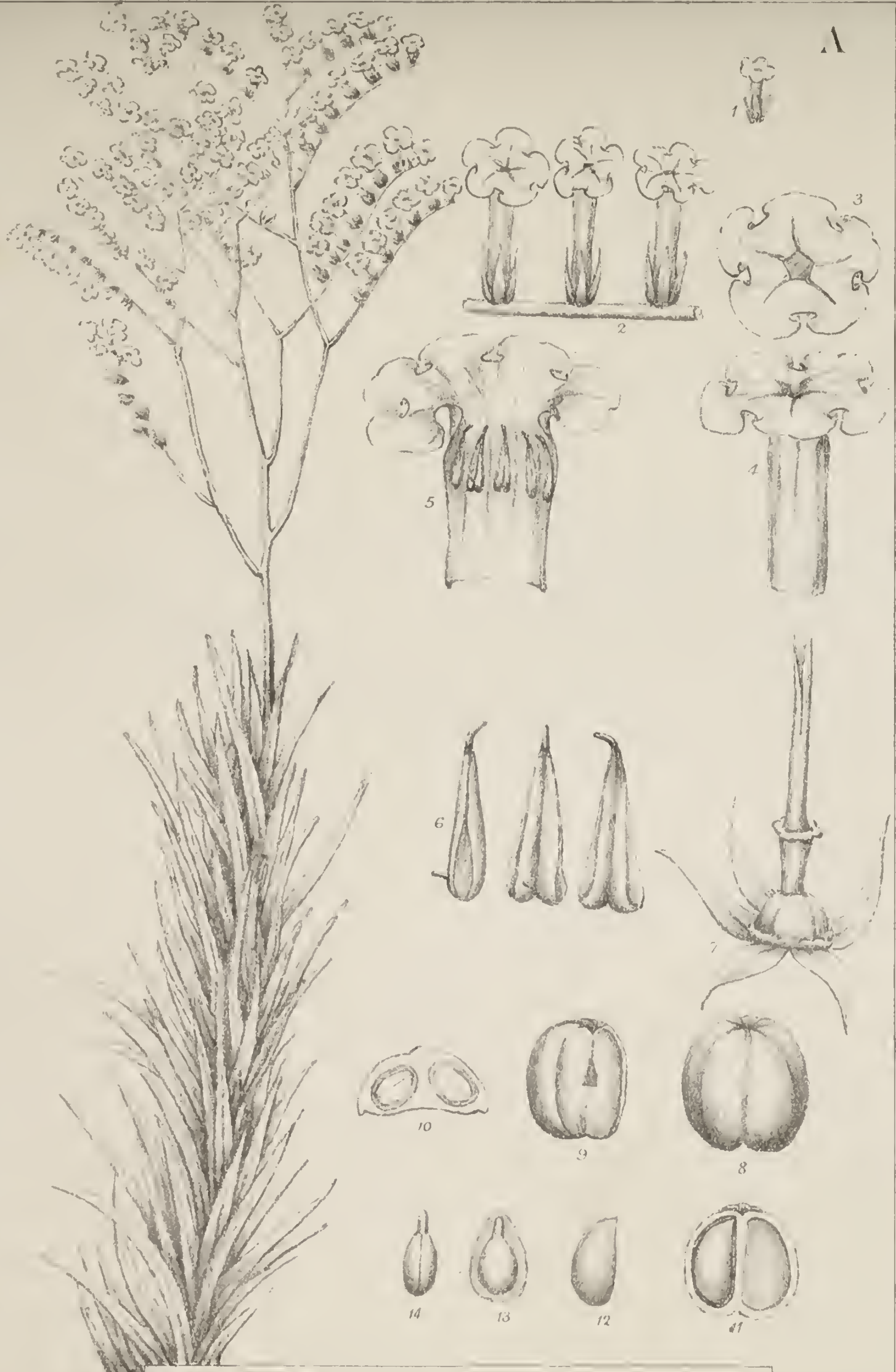
A TRIBULOIDES

ACICARPA.

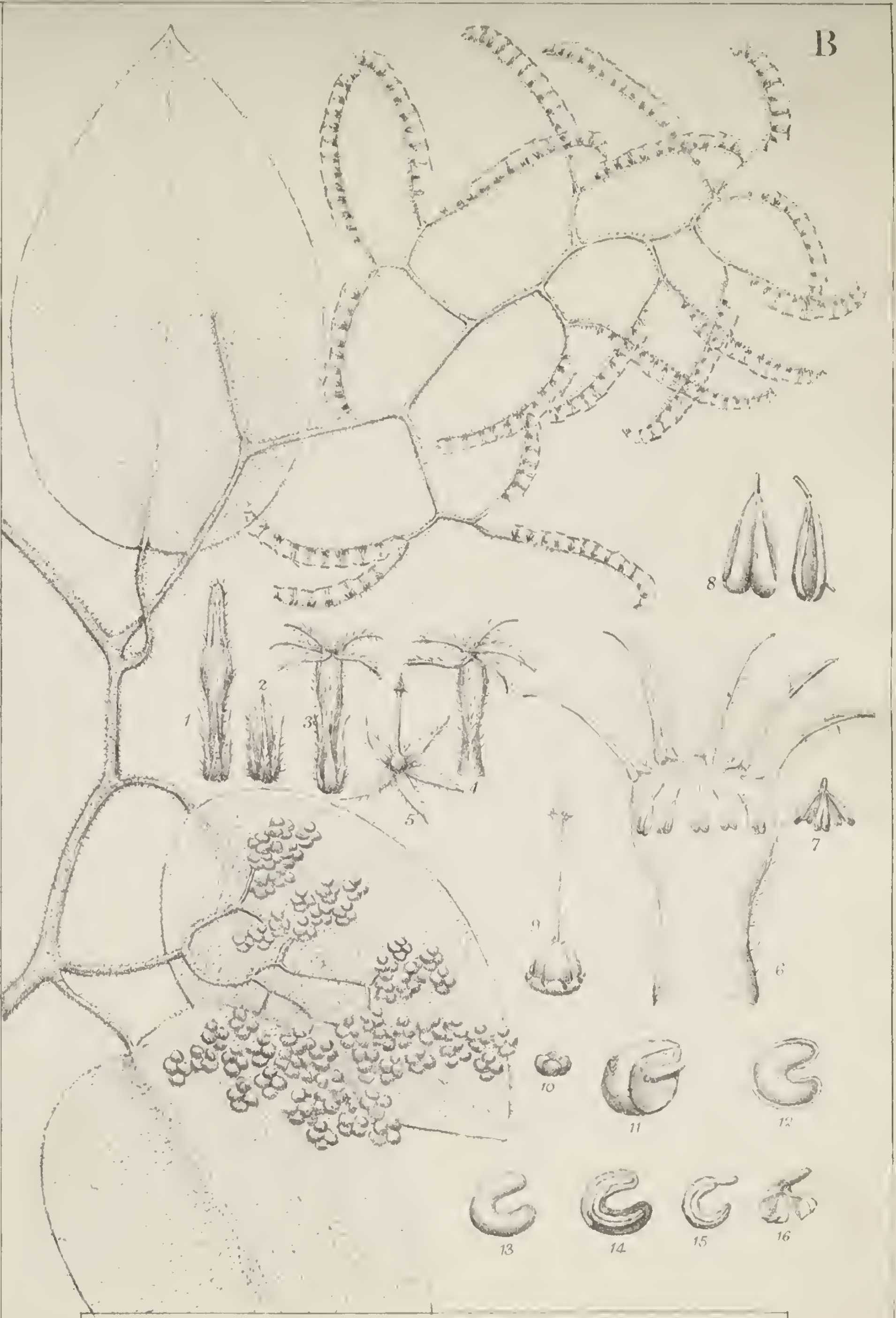
A. PINNATIFIDA

J Miers, del

W West, imp



COCHRANEA CONFERTA

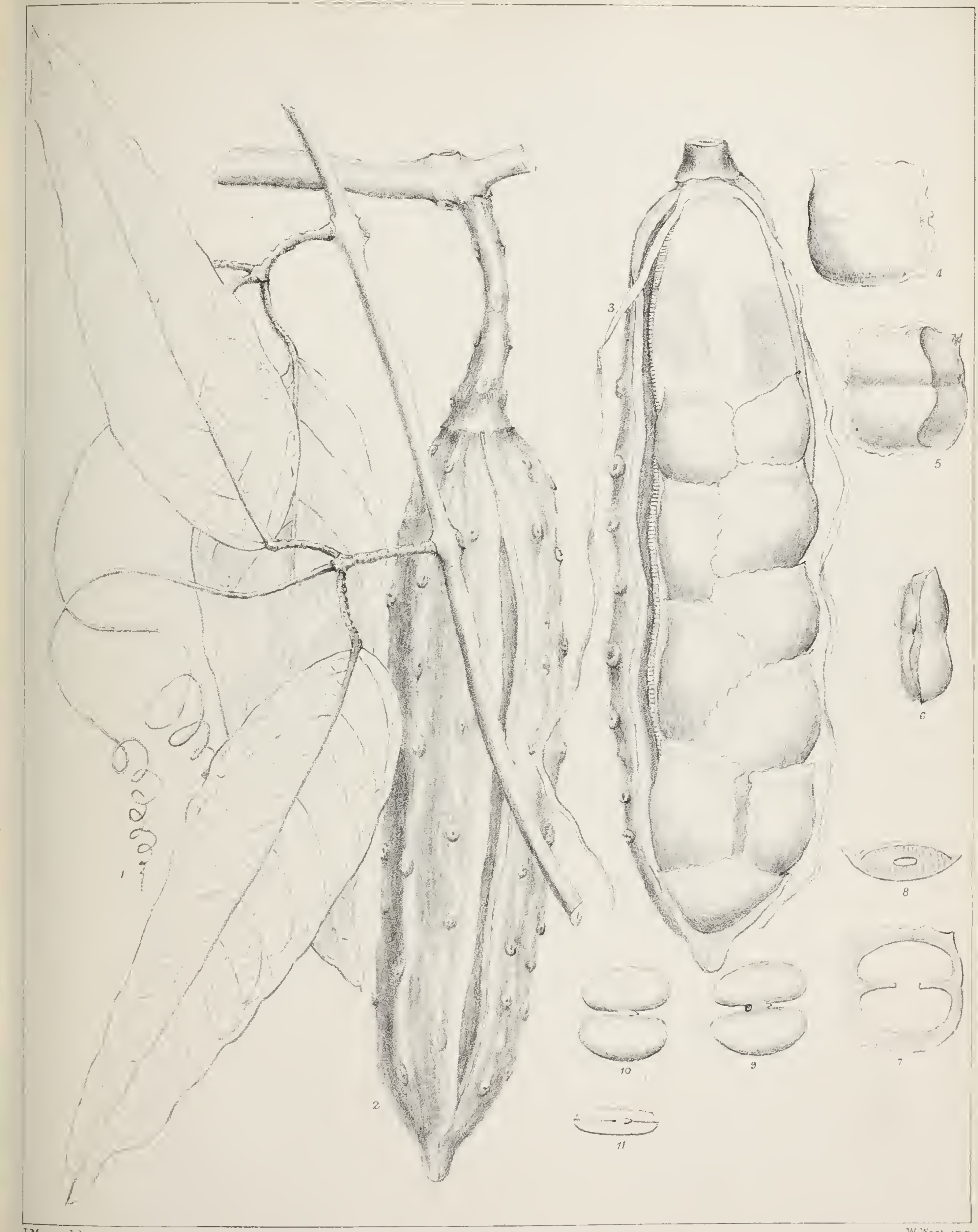


MESSERSCHMIDTIA MEMBRANACEA

J. Miers, del.

W W [illegible]

Plate 54



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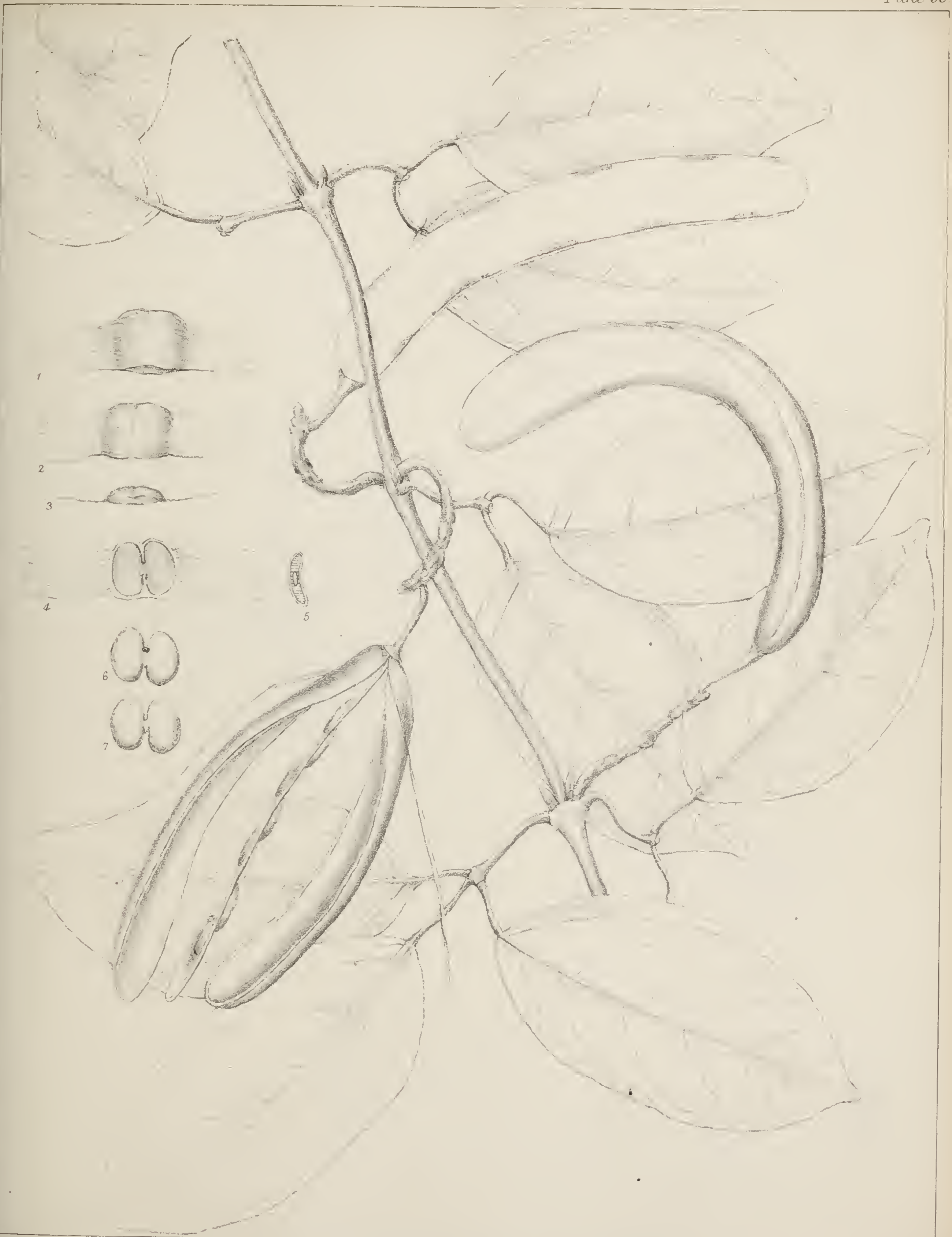
W. West imp.

ADENOCALYMNA PREHENSILE



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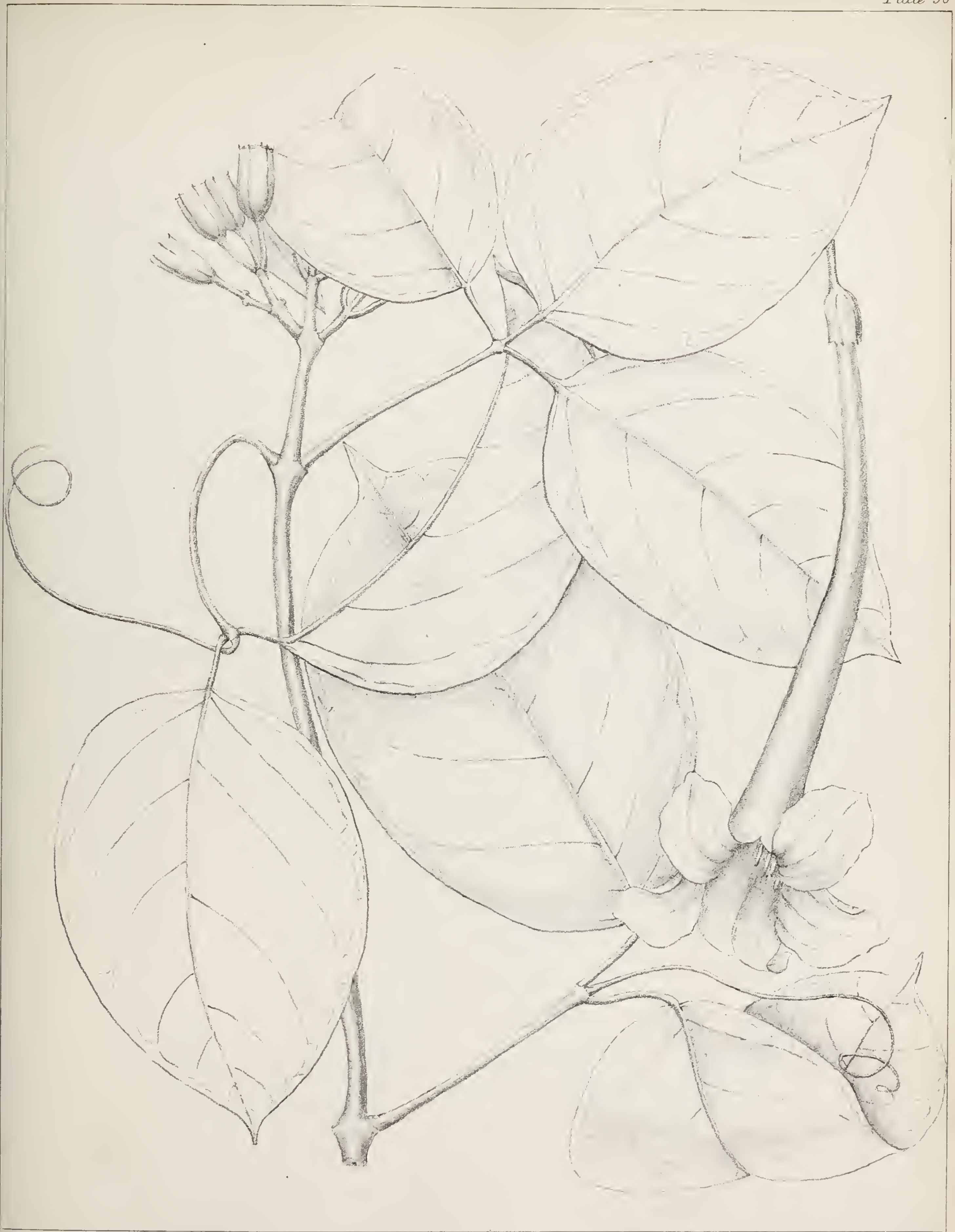
ADENOCALYMNA ? CŒSIUM.



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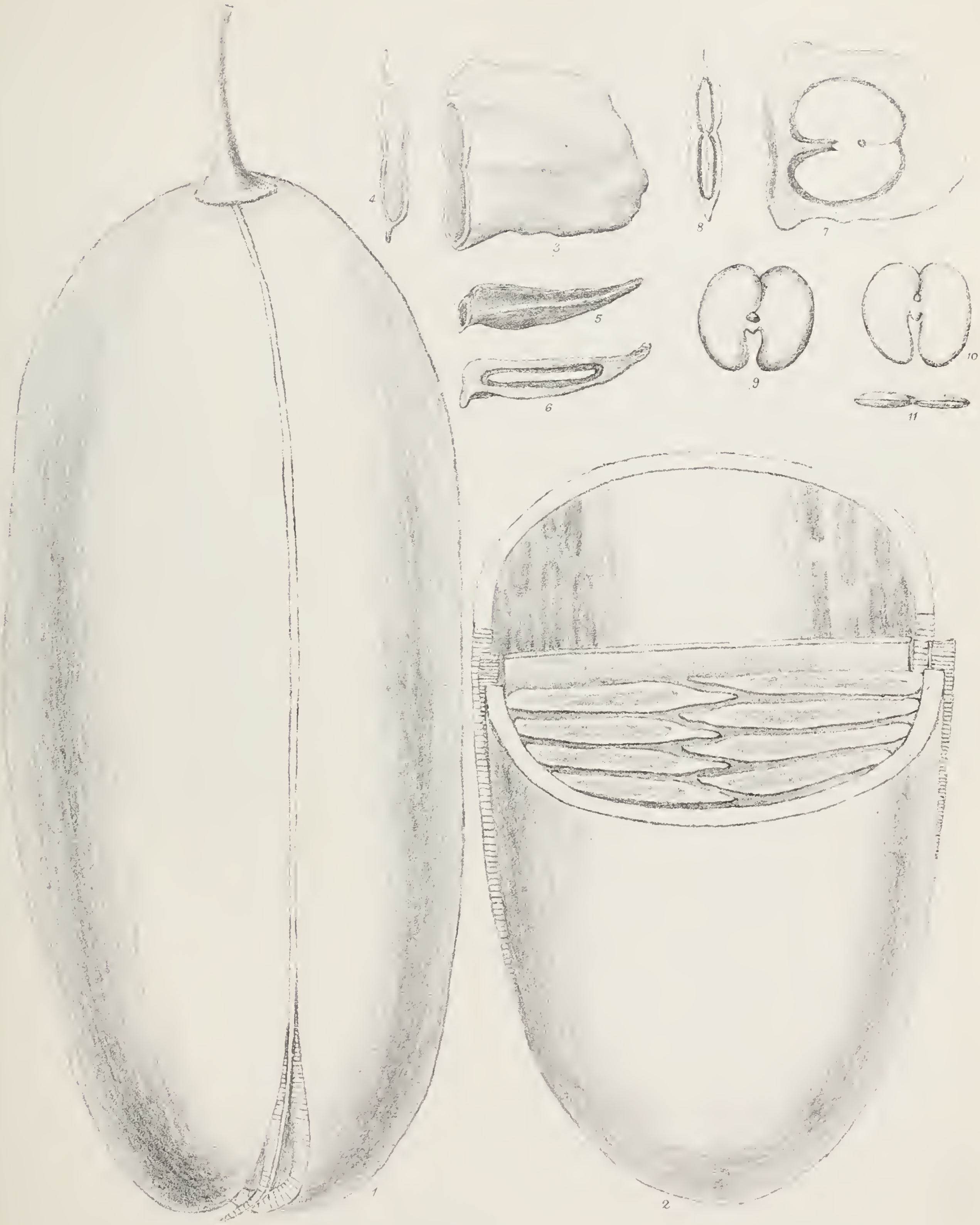
TANAECIUM ALBIFLORUM



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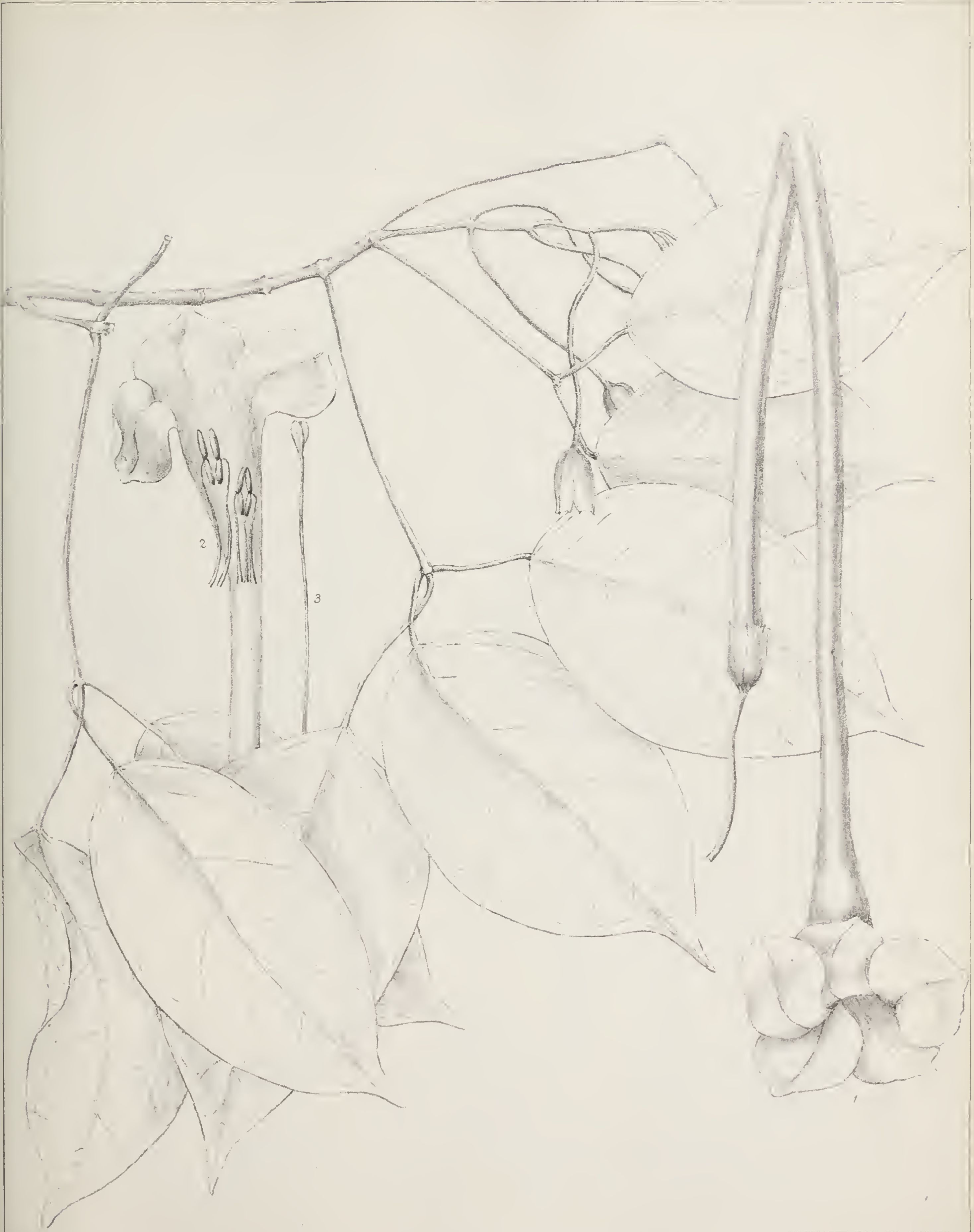
TANAECIUM ALBIFLORUM



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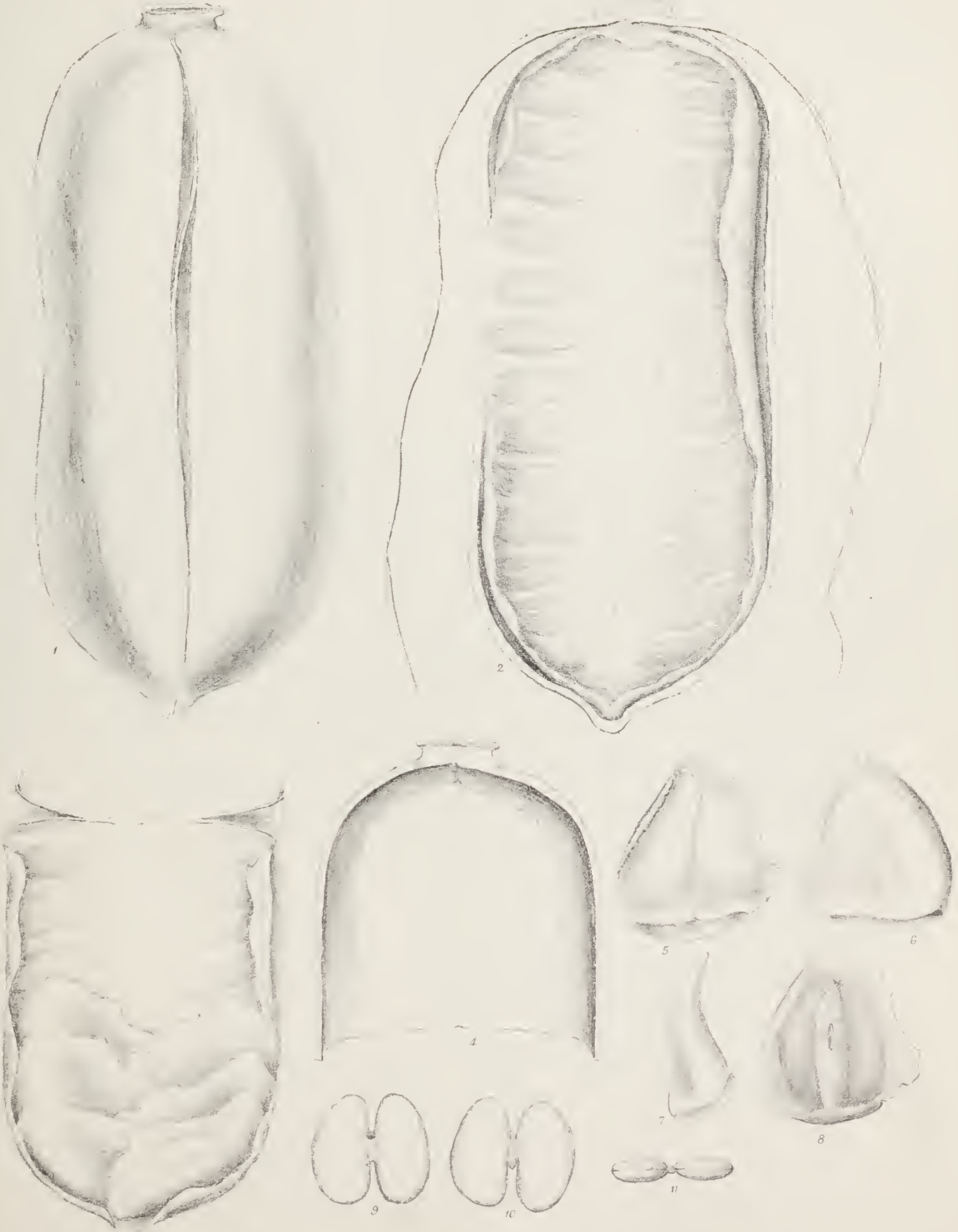
W West imp

TANAECIUM PRÆLONGUM.



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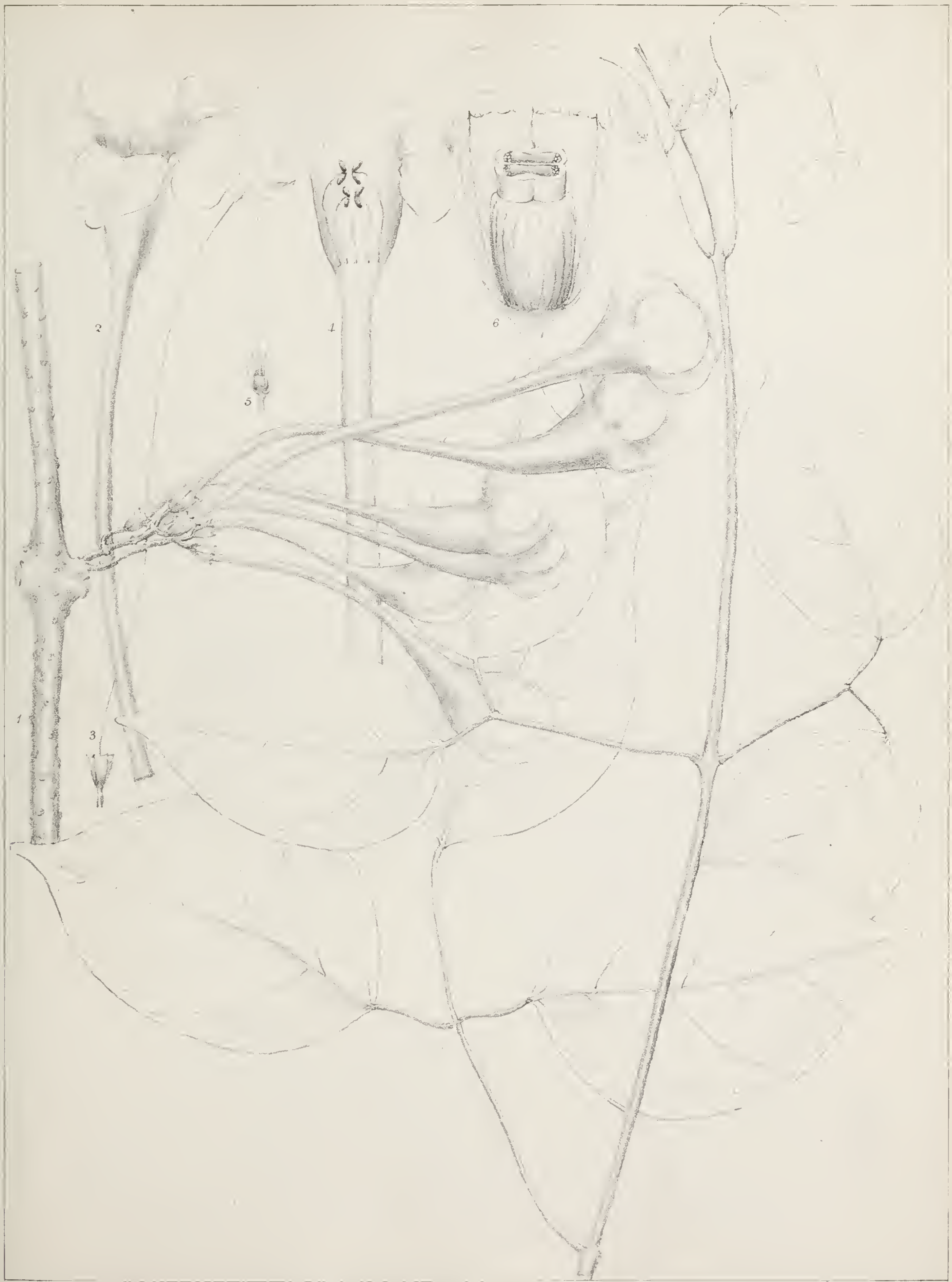
TANAECIUM PRÆLONGUM.

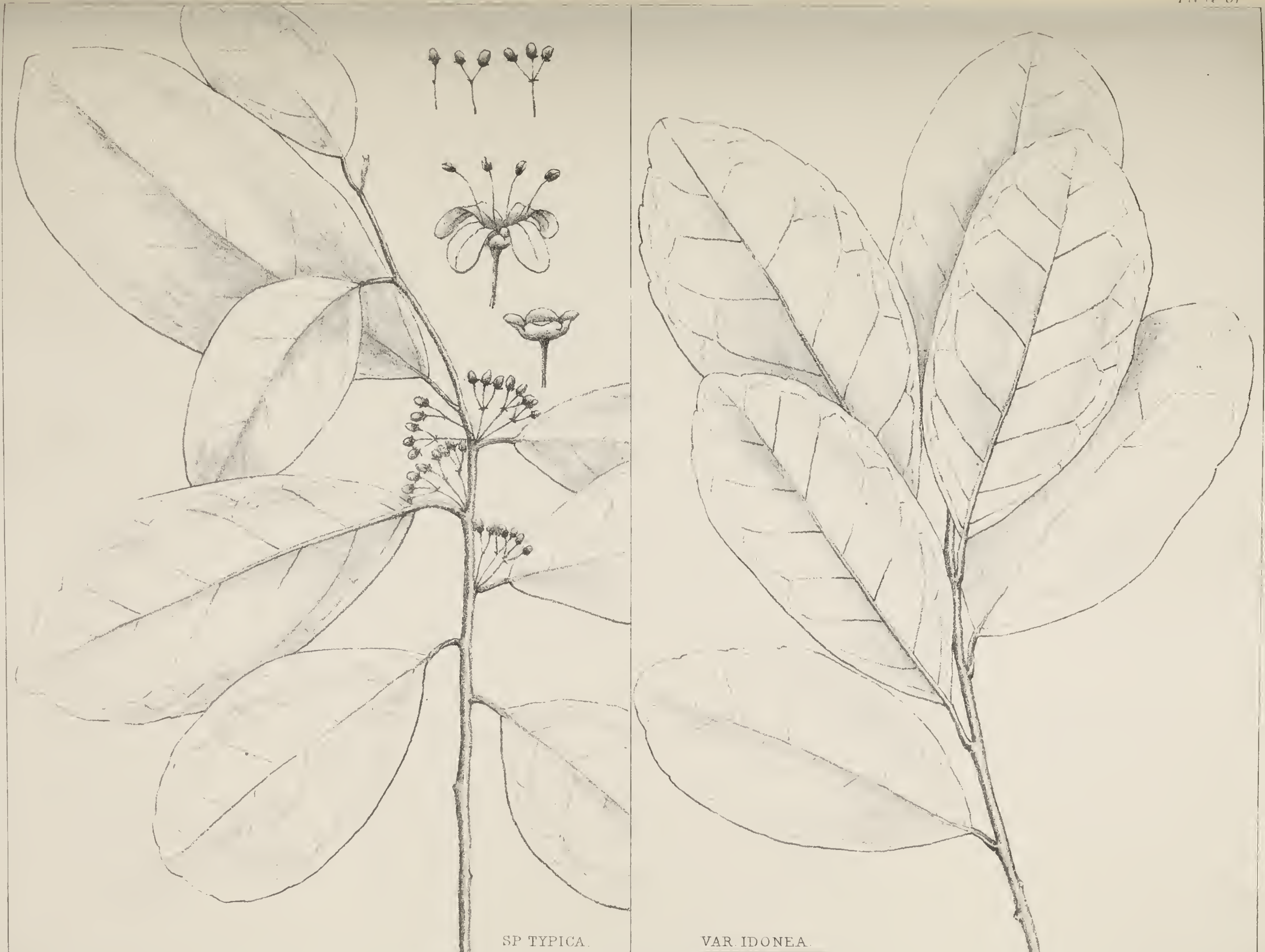
Plate 60



J Miers, del

W West imp.

TANAECIUM BRASILIENSE



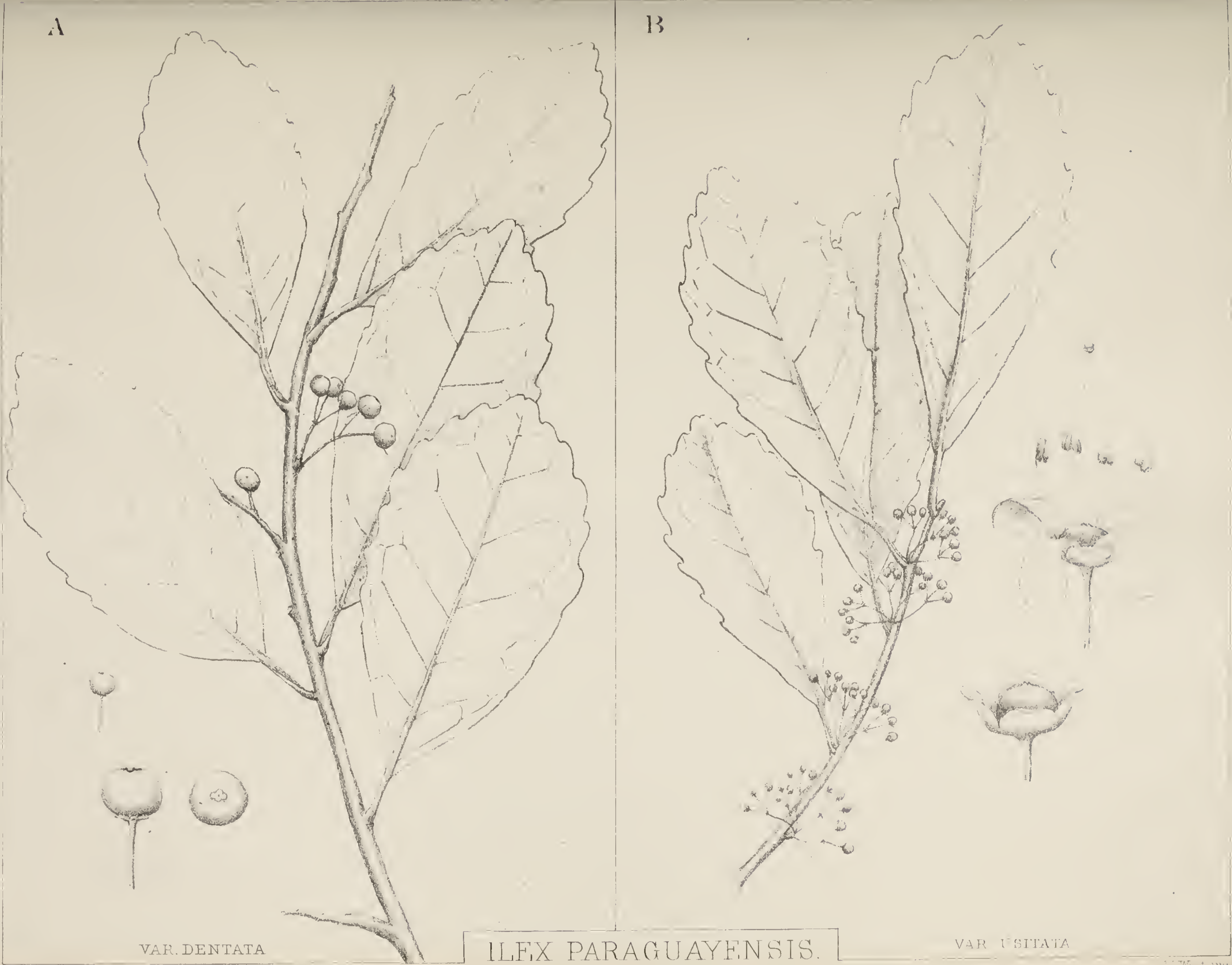
SP TYPICA.

VAR. IDONEA.

ILEX PARAGUAYENSIS

J Miers, del

W West imp



ILEX PARAGUAYENSIS.

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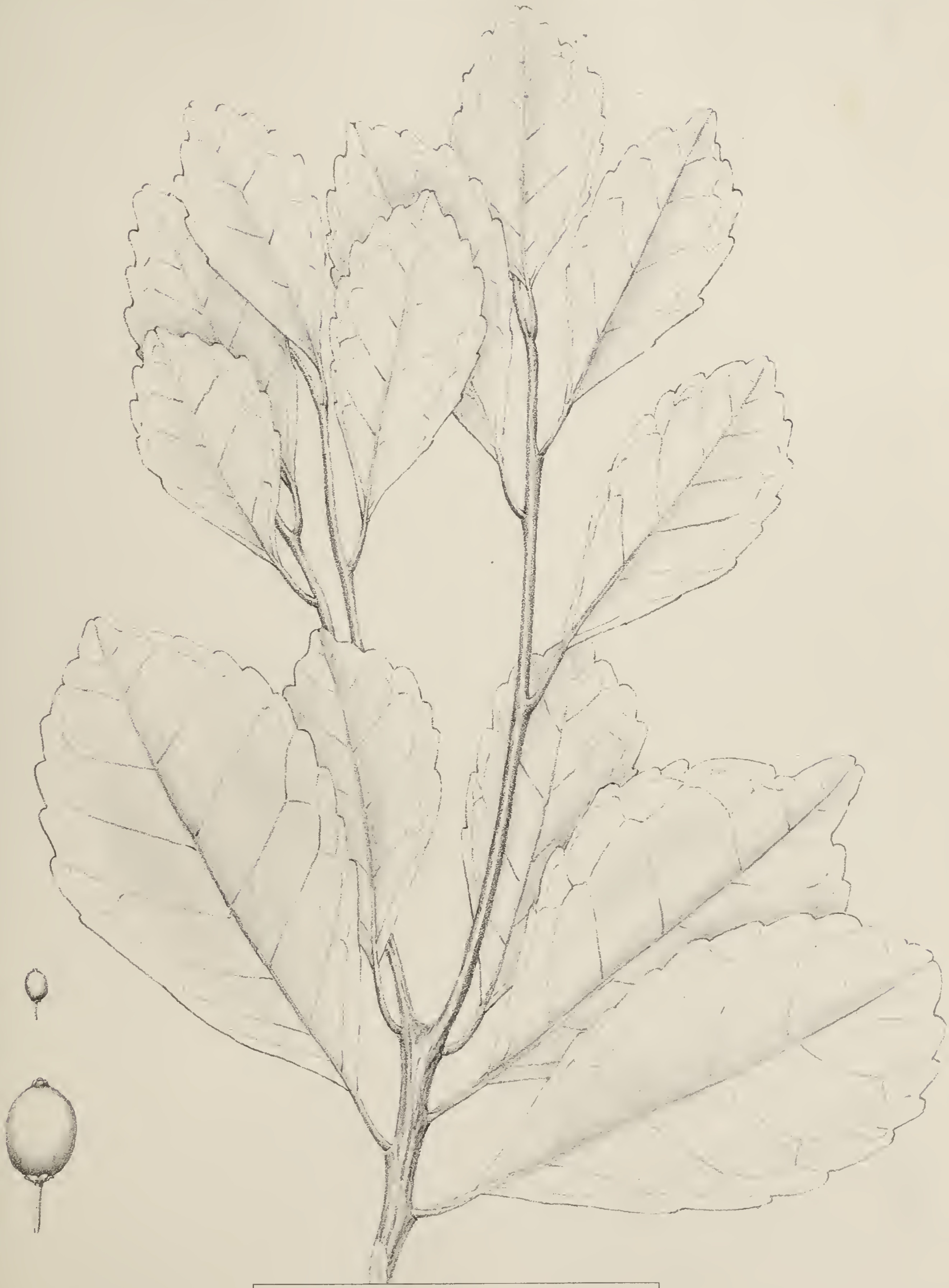

ILEX CURITIBENSIS.

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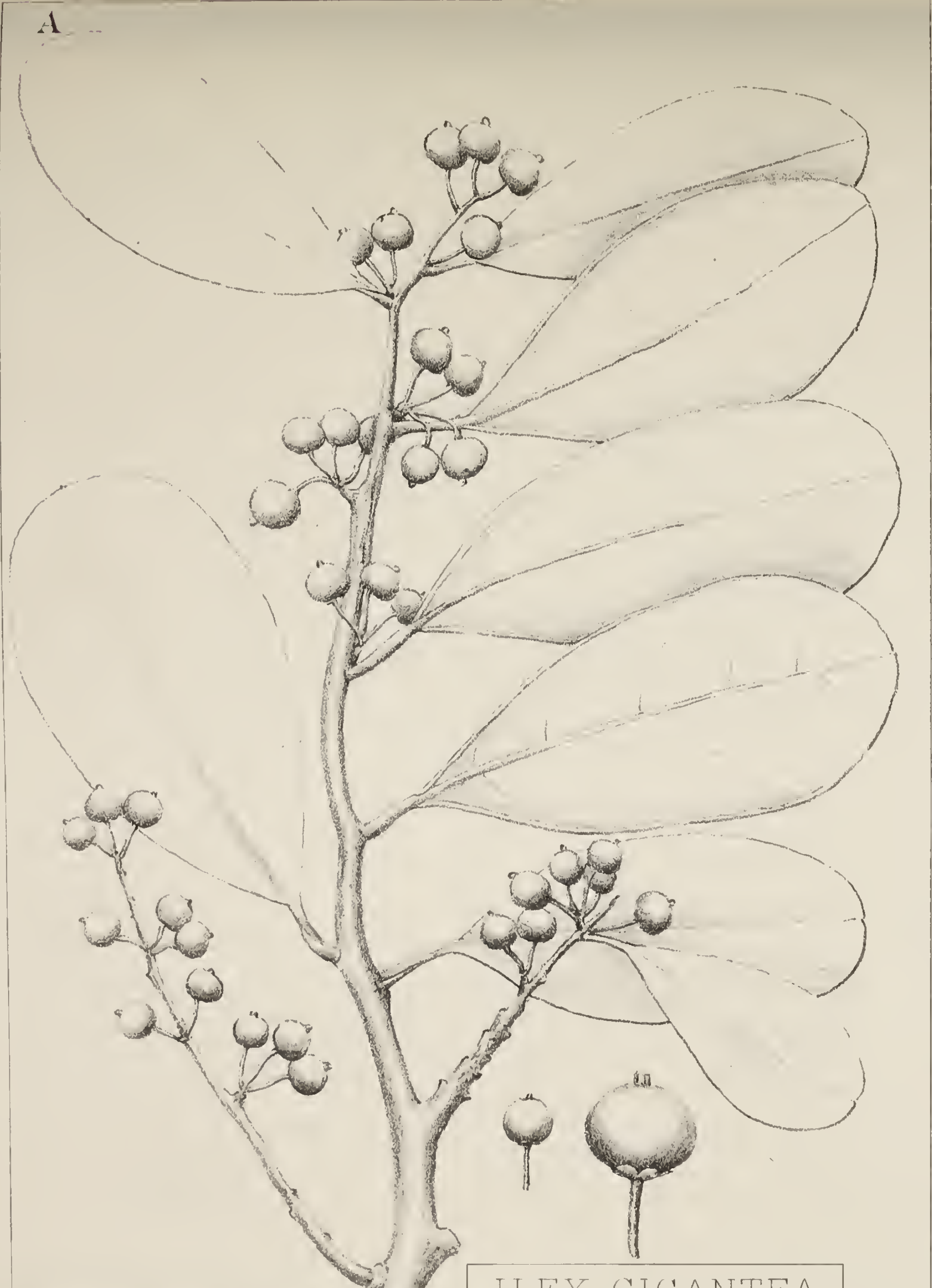
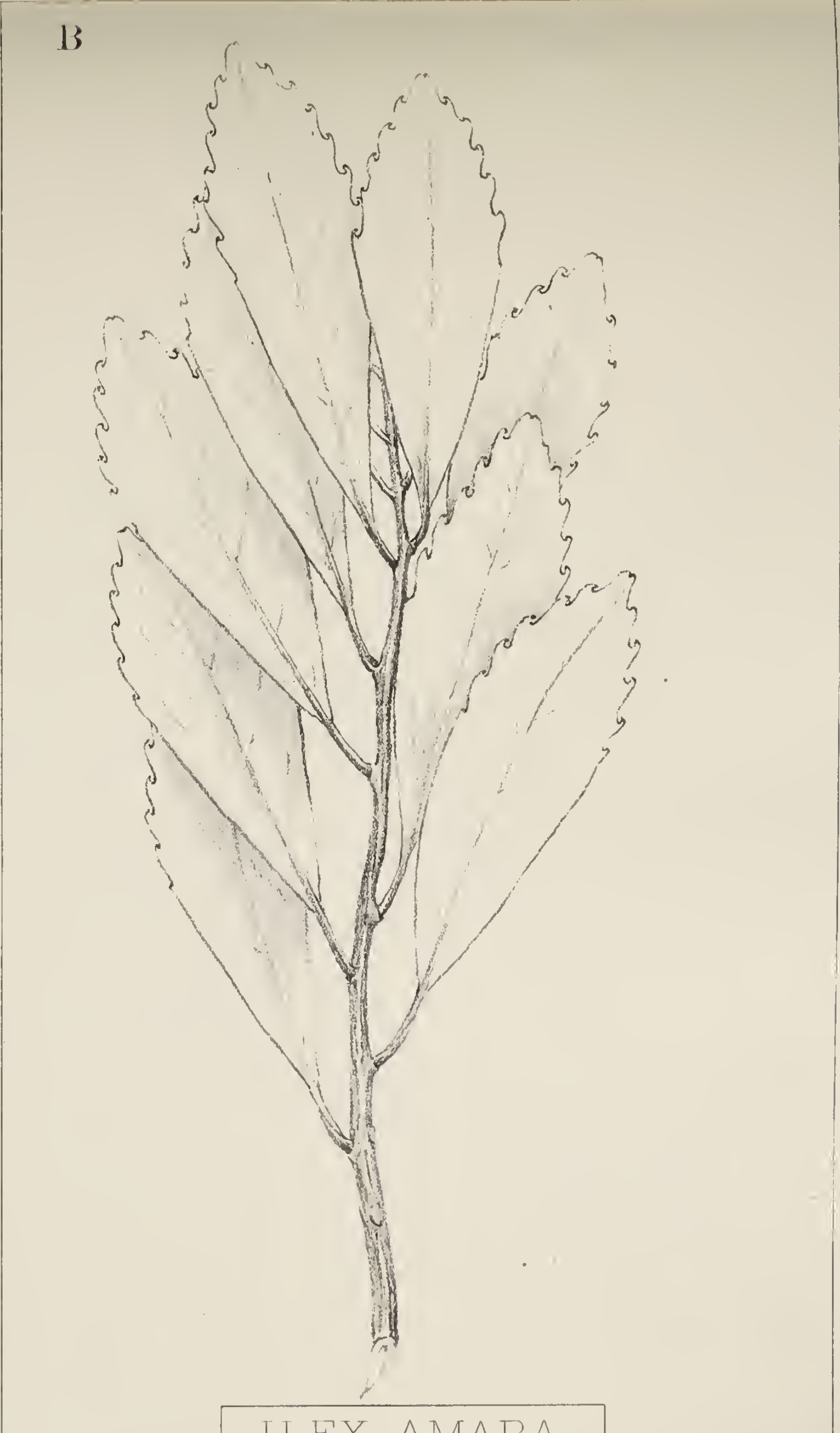


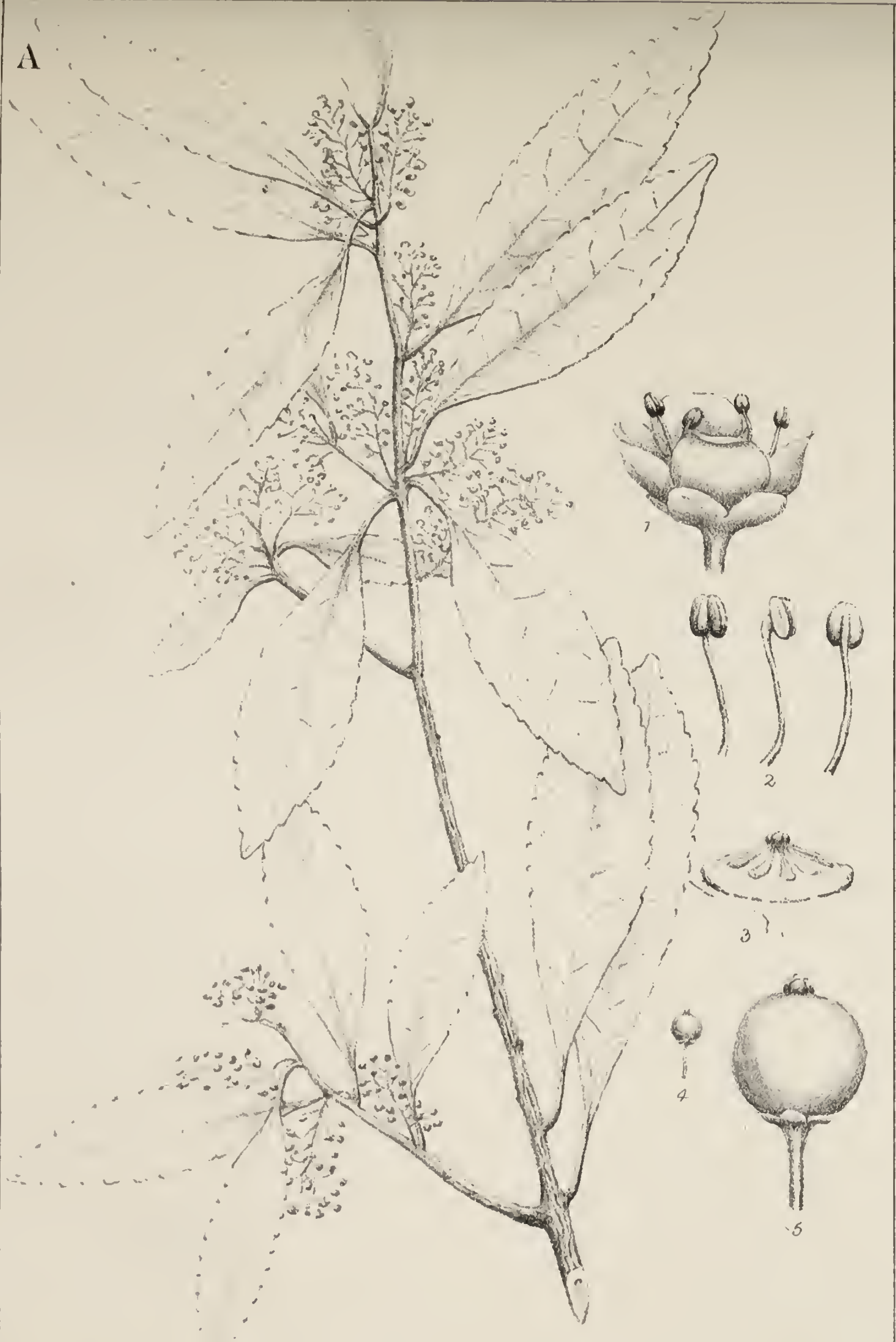
ILEX GIGANTEA.



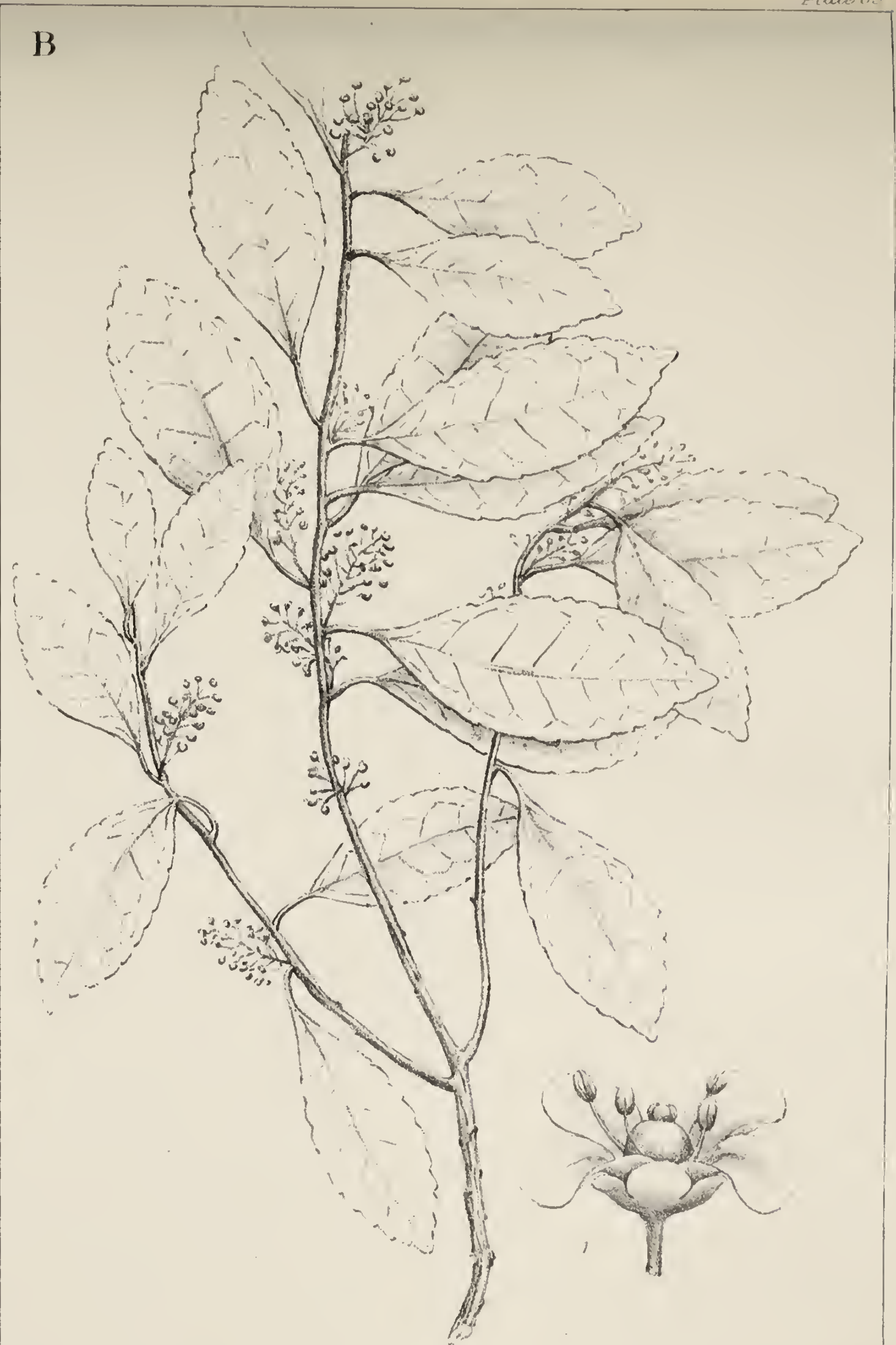
ILEX AMARA.

J. Miers, del.

W. West, imp.



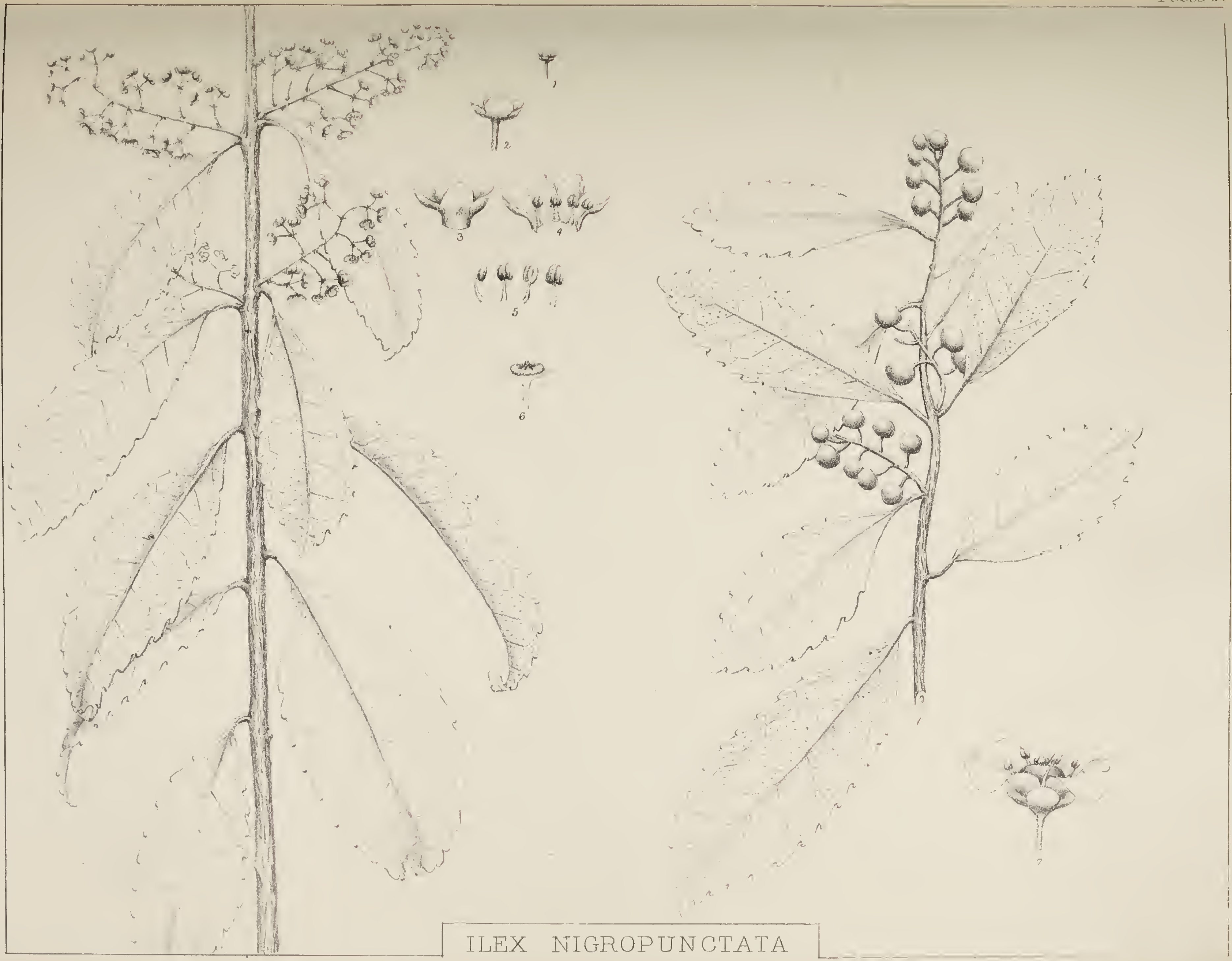
ILEX HUMBOLDTIANA



ILEX OVALIFOLIA

J Miers, del

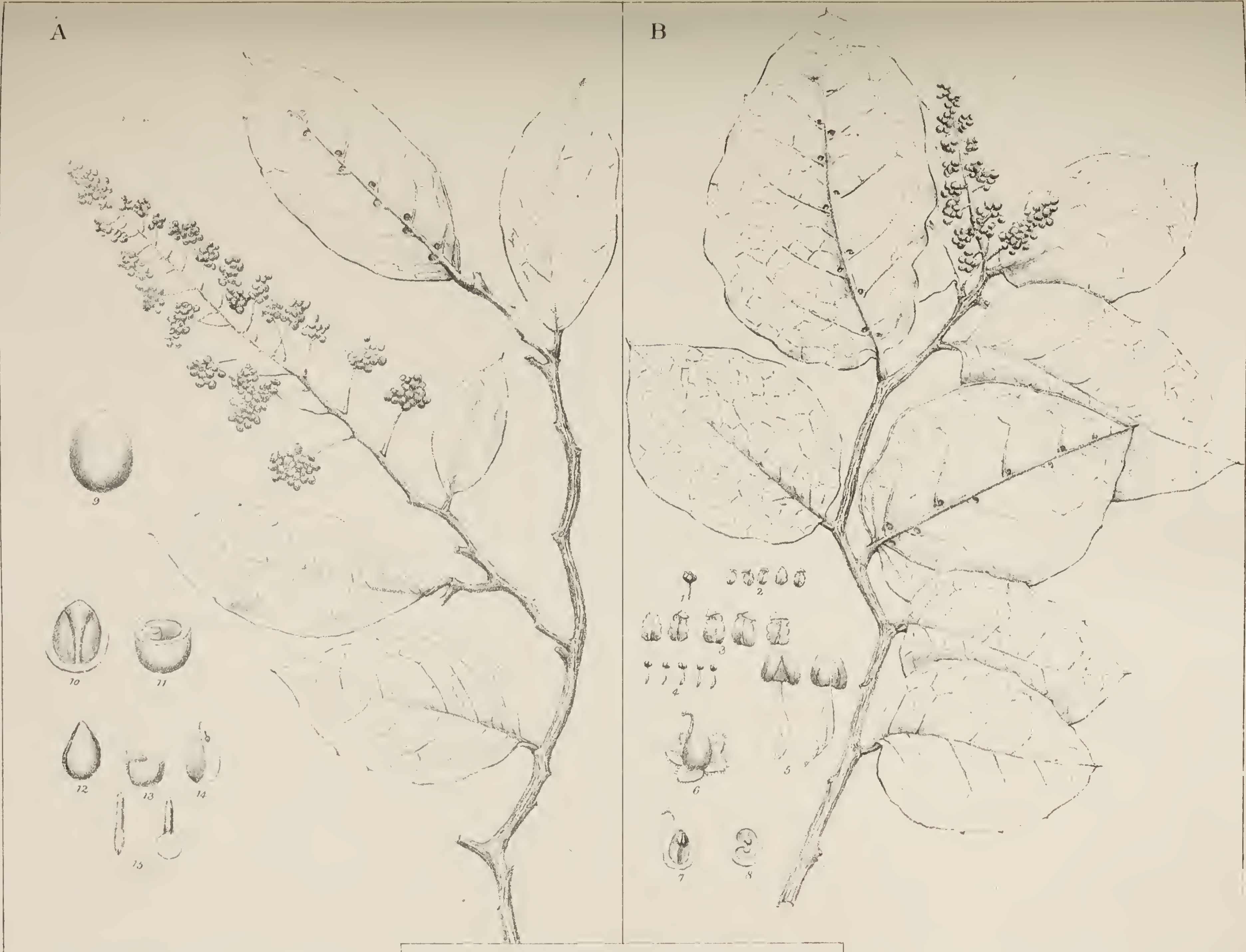
W West, imp



ILEX NIGROPUNCTATA

J Miers del

W West lith



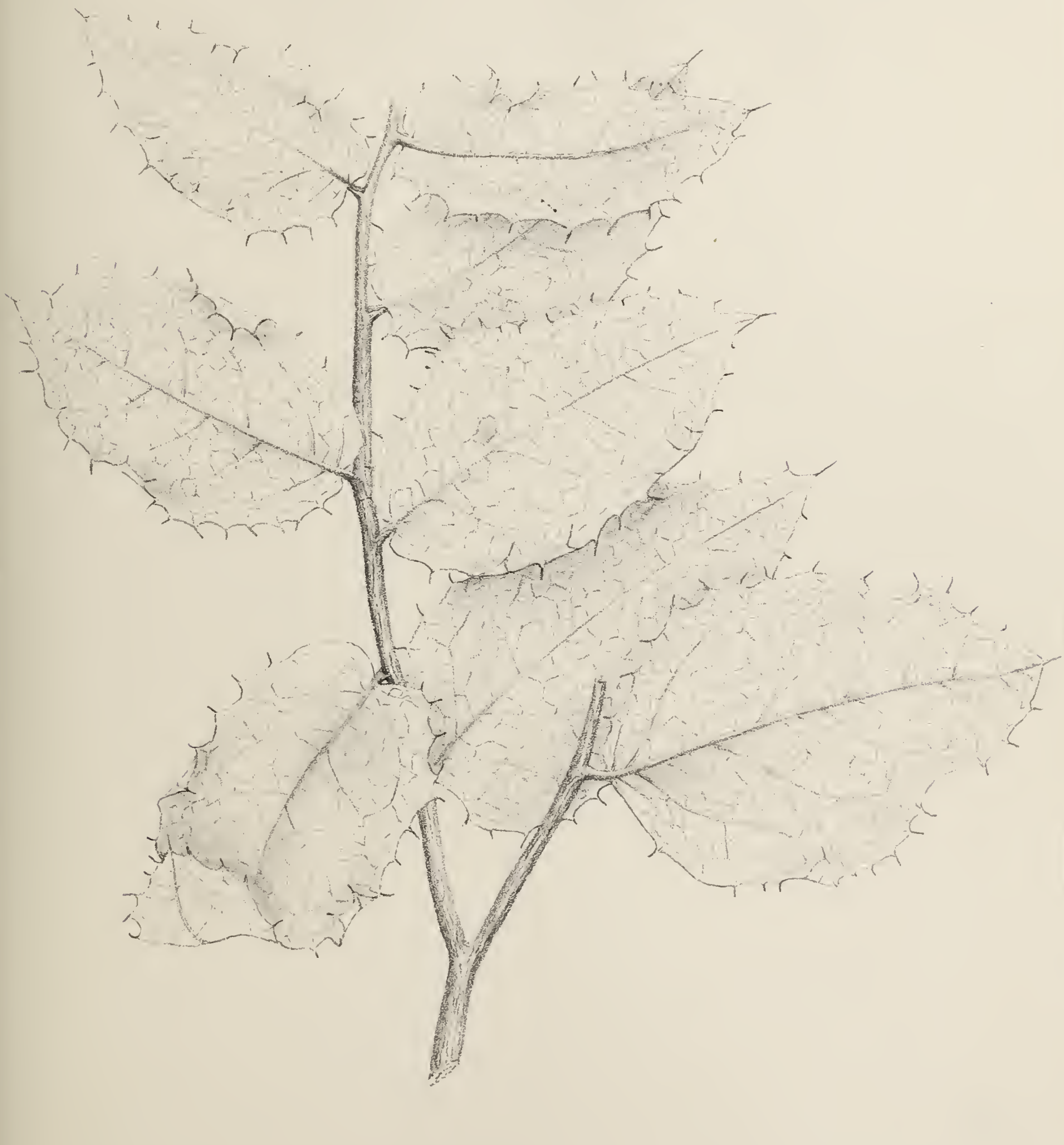
SP. TYPICA

VAR. LÆTA

VILLARESIA MUCRONATA

J. Miers del.

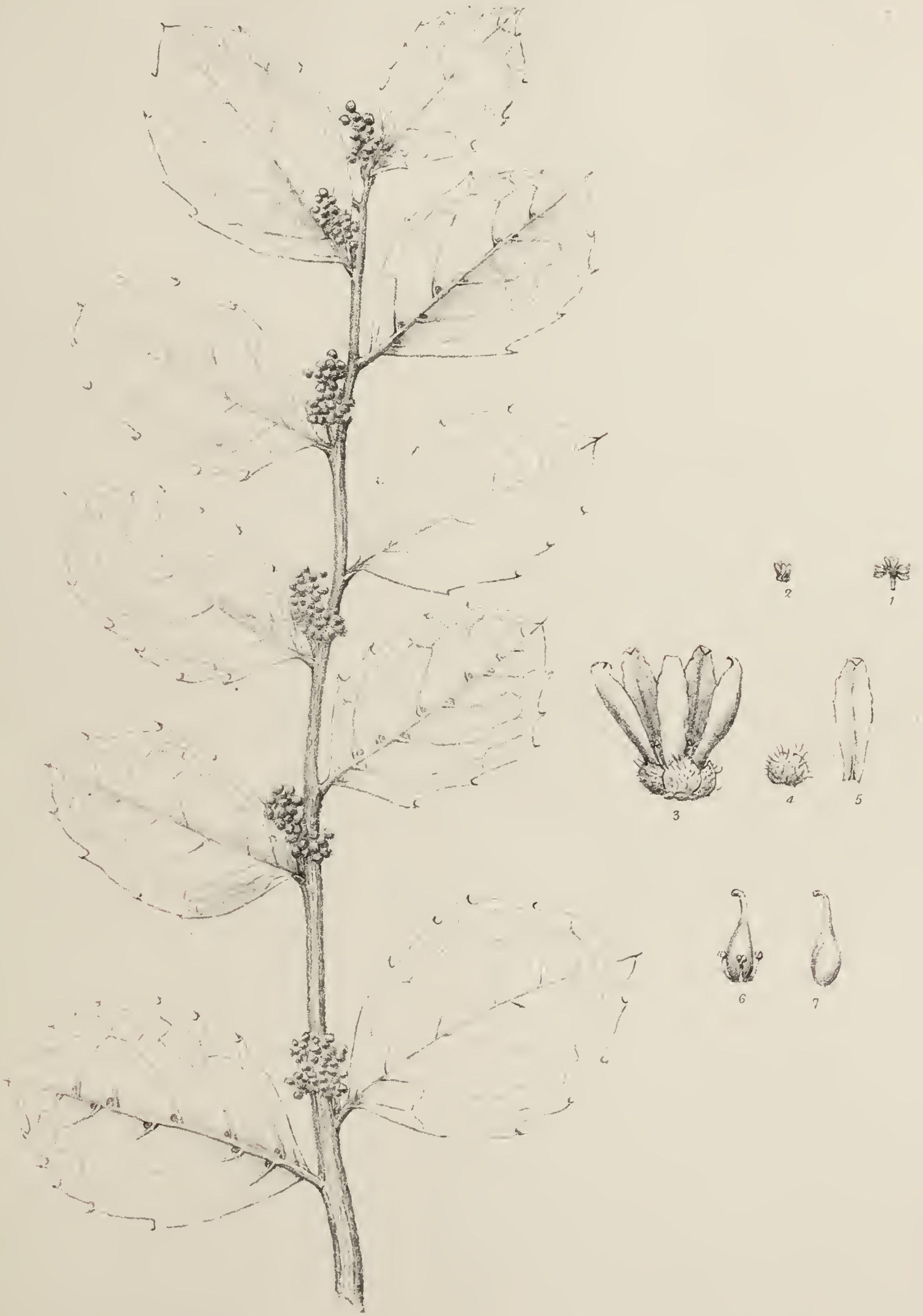
W. West imp.



J. Miers, del.

W. West imp.

VILLARESIA PUNGENS

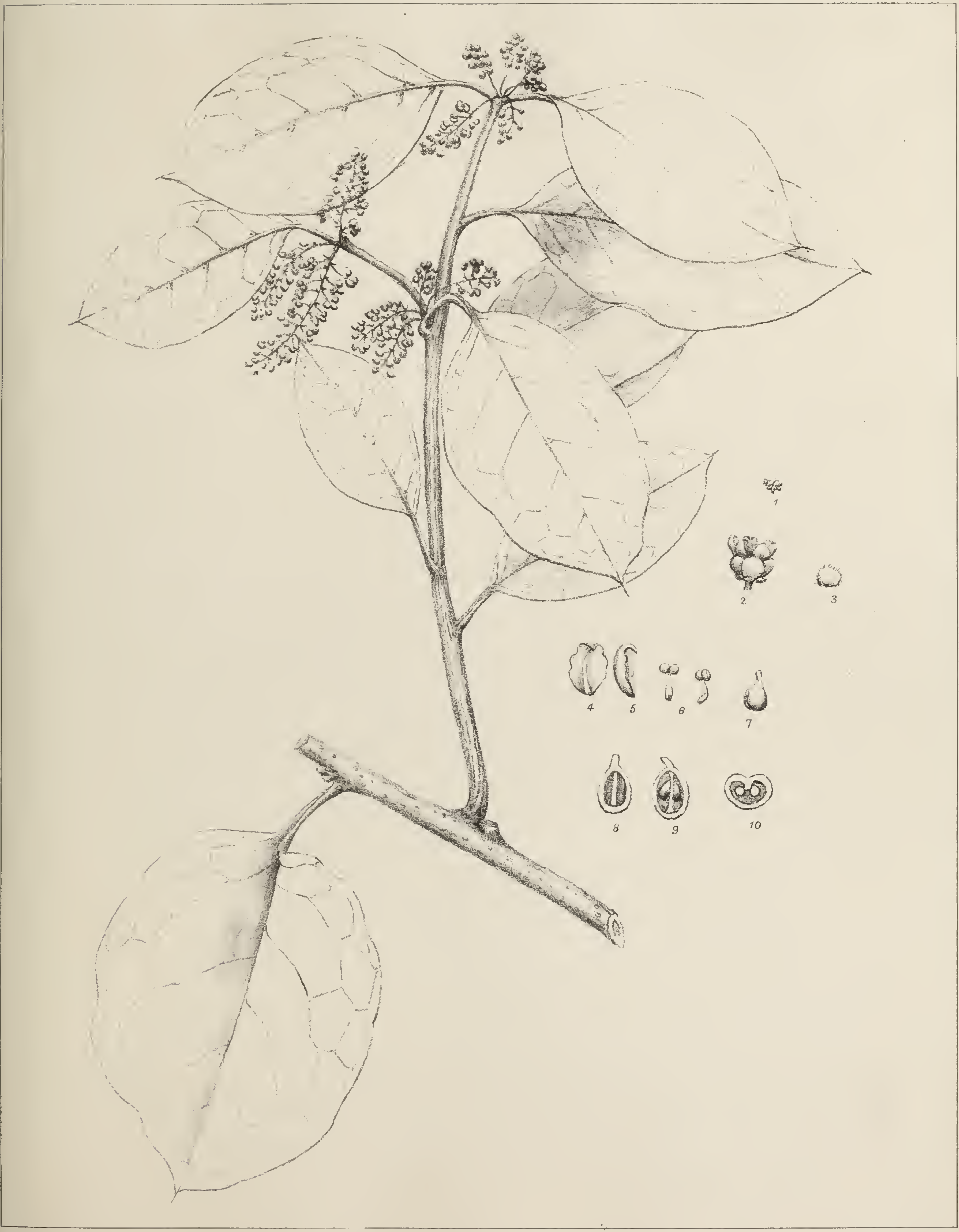


J Miers, del

W West, imp

VILLARESIA CONGONHA.

Plate 70.

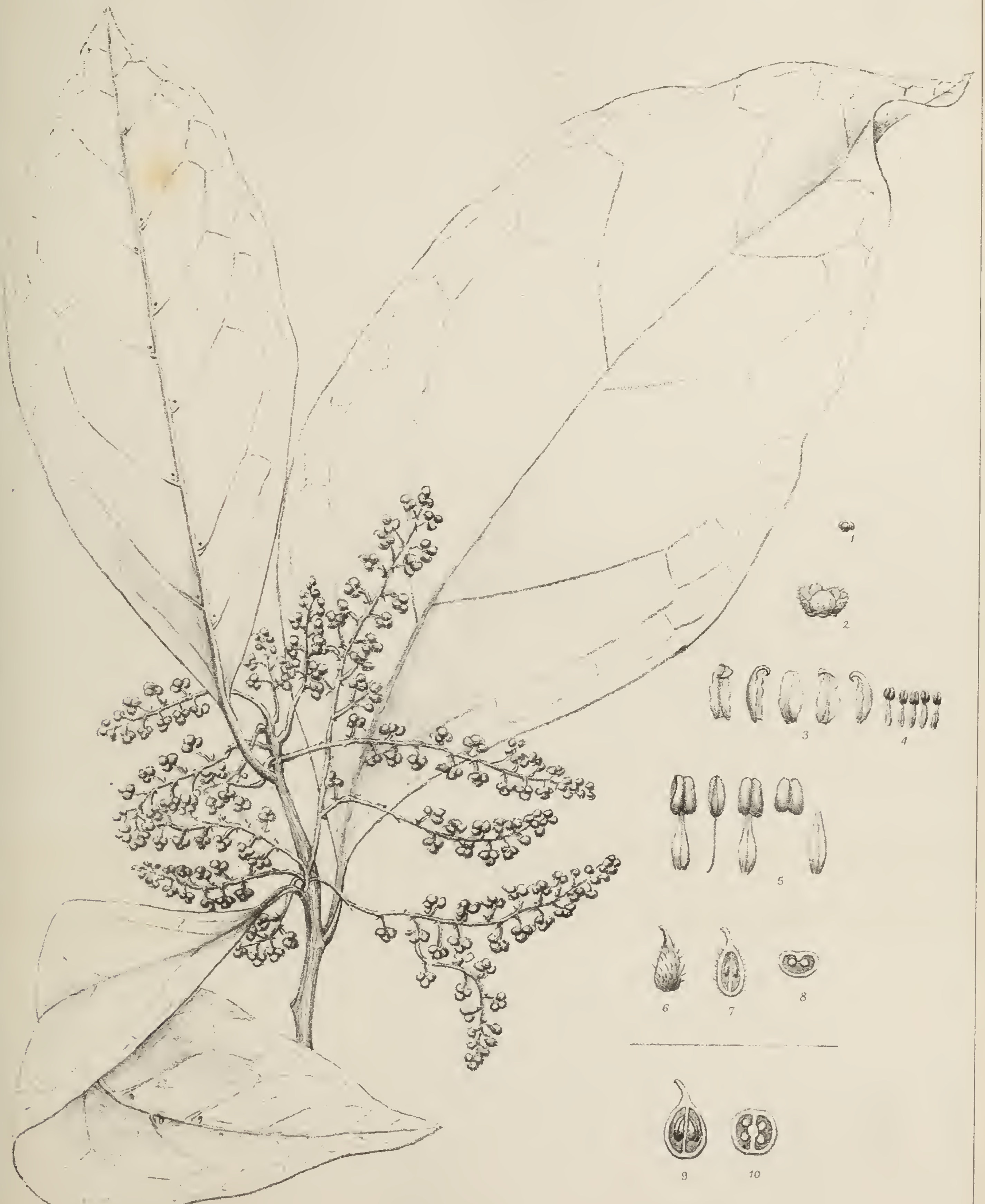


J Miers, del

W West imp

VILLARESIA CUSPIDATA.

Plate 71.

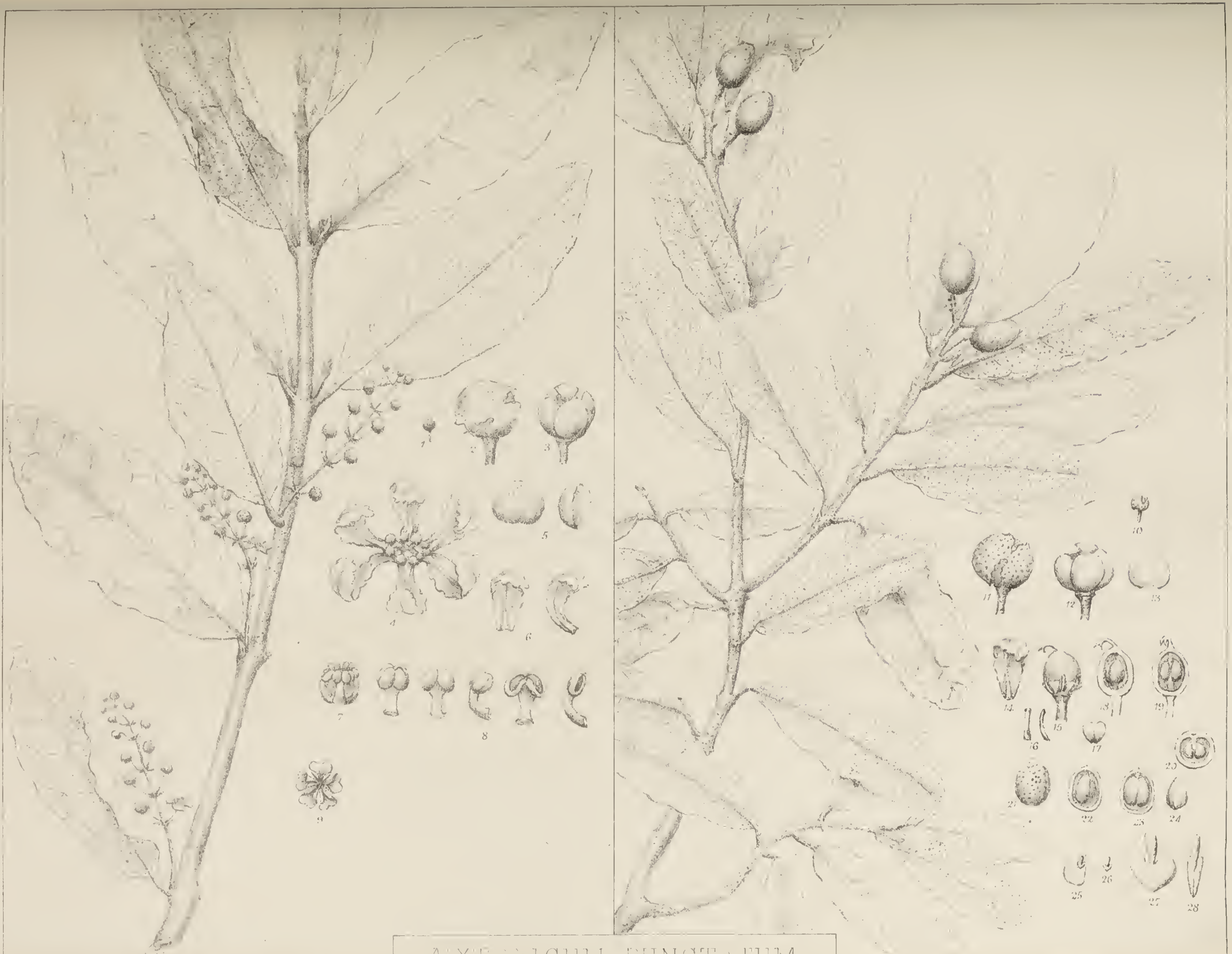


J. Miers, del

W West, imp

MEGA
VILLARESIA ~~MACRO~~PHYLLA.

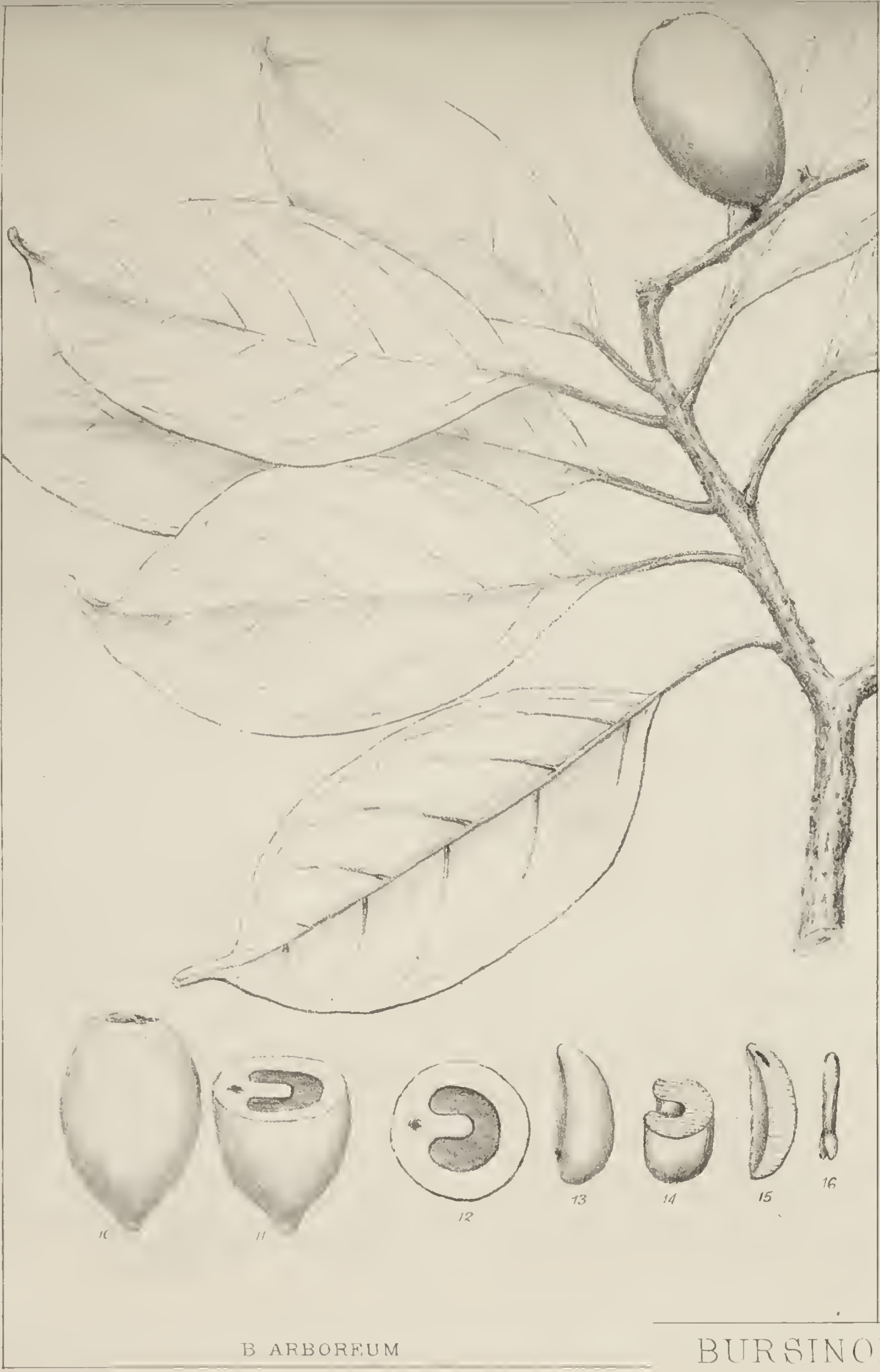
Plate 72



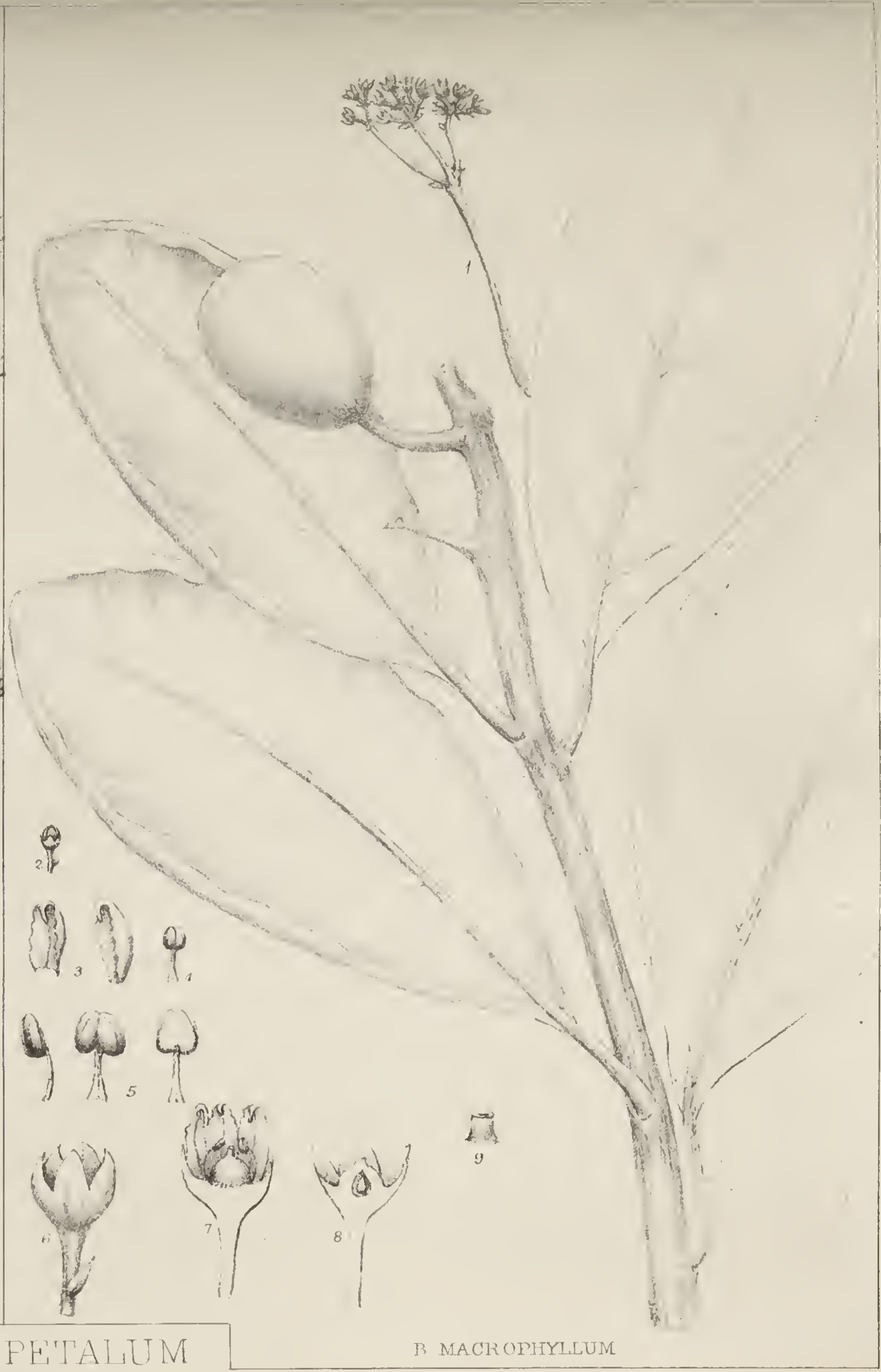
ÆXTOXICUM PUNCTATUM

W. West, imp.

Plate 12



B ARBOREUM



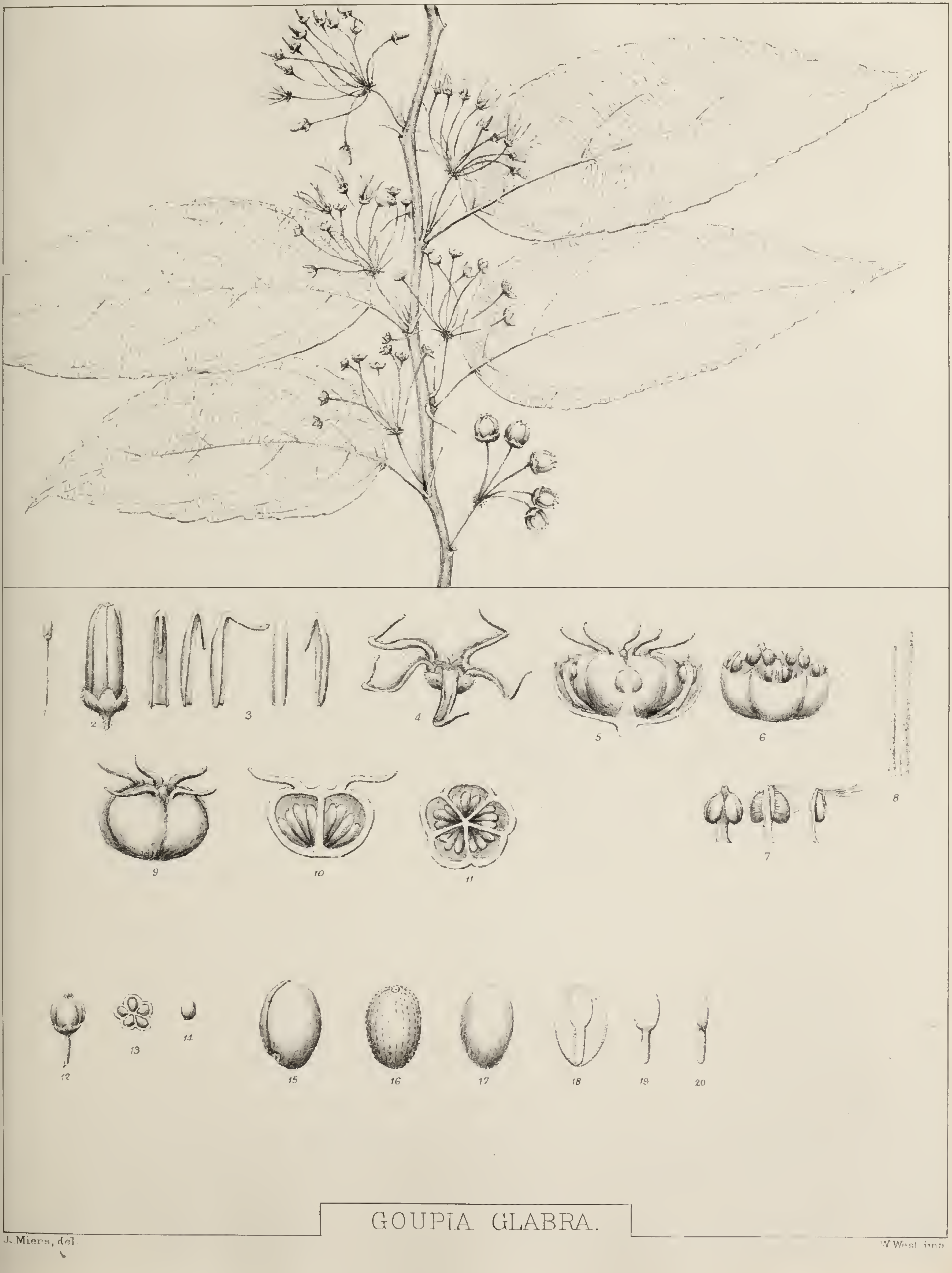
B MACROPHYLLUM

BURSINOPETALUM

J Miers del

W West imp

Plate 74

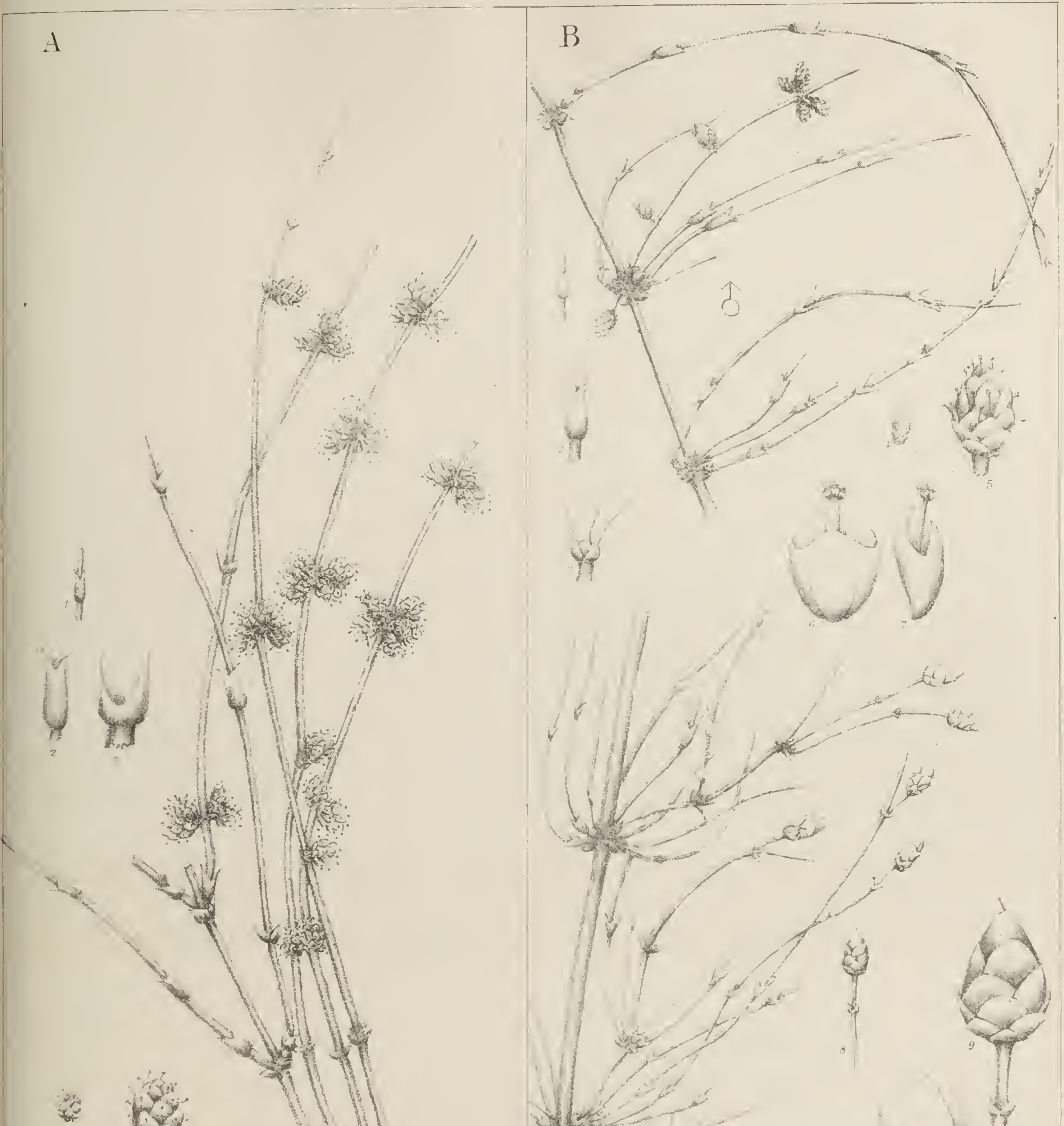


GOUPIA GLABRA.

J. Miers, del.

W West imp.

Plate 75.



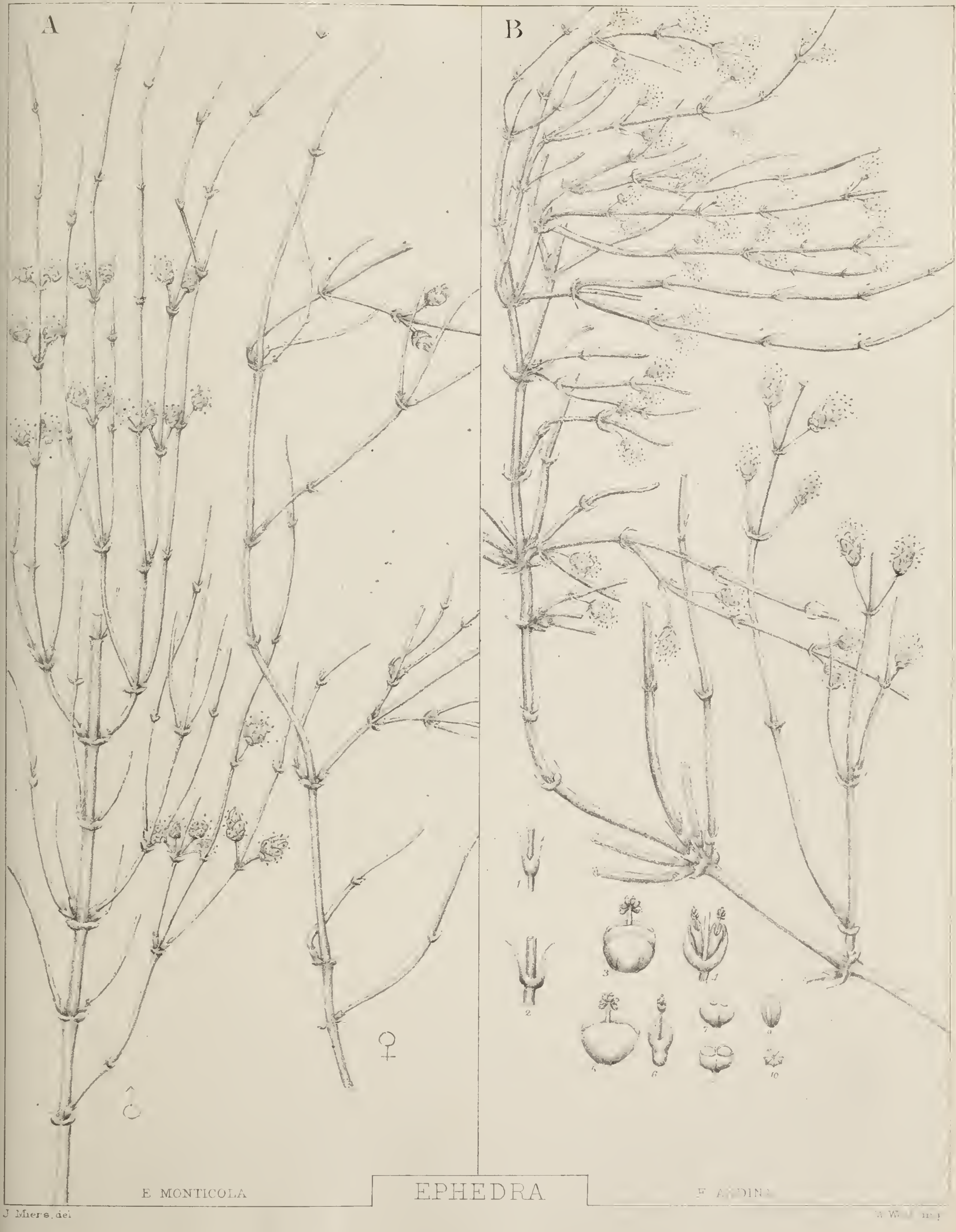
E CHILENSIS

EPHEDRA.

E BRACTEATA.

J Miers, del

W West, imp



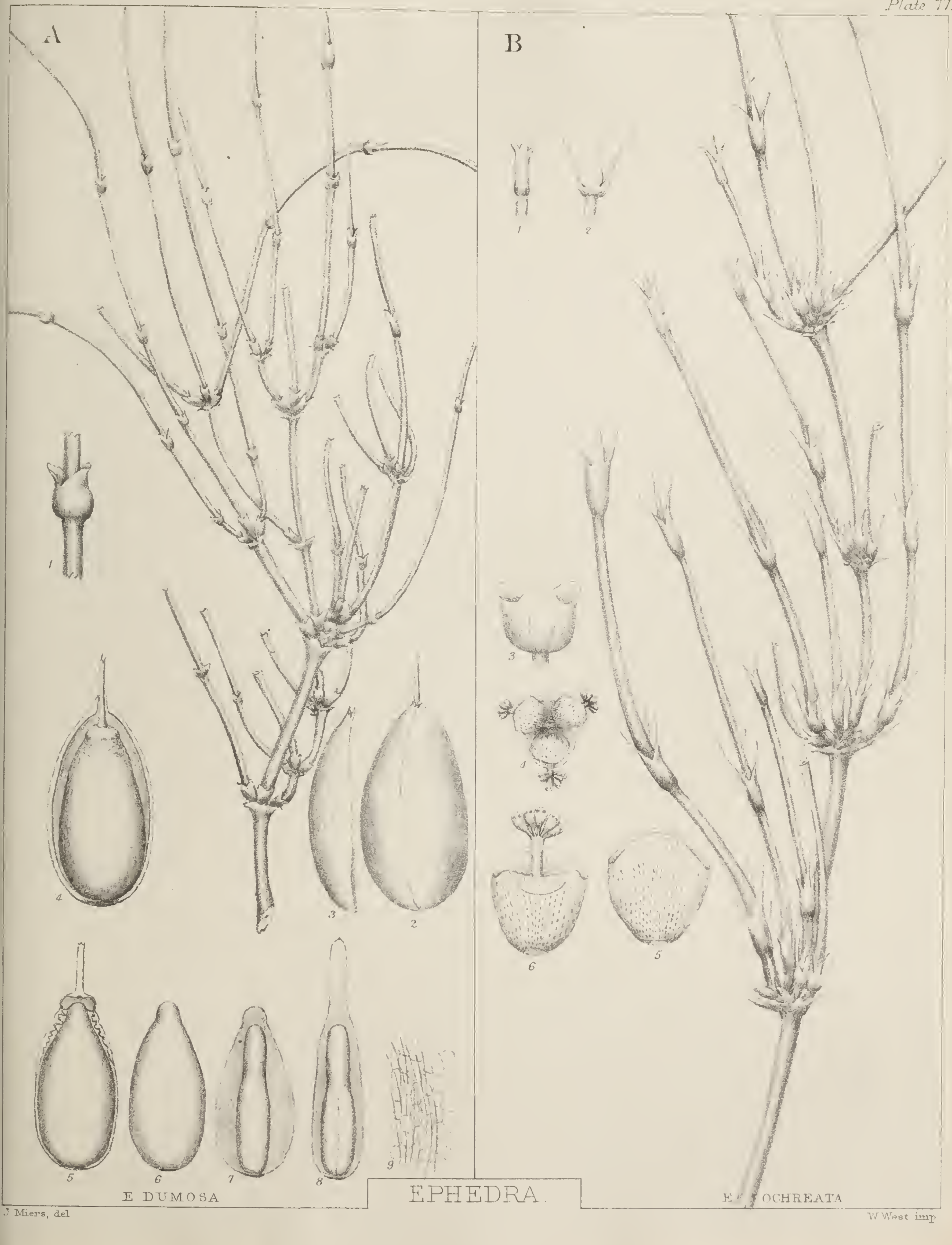
E. MONTICOLA

EPHEDRA

E. ANDINA

J. Miers, del.

W. W. imp.



E DUMOSA

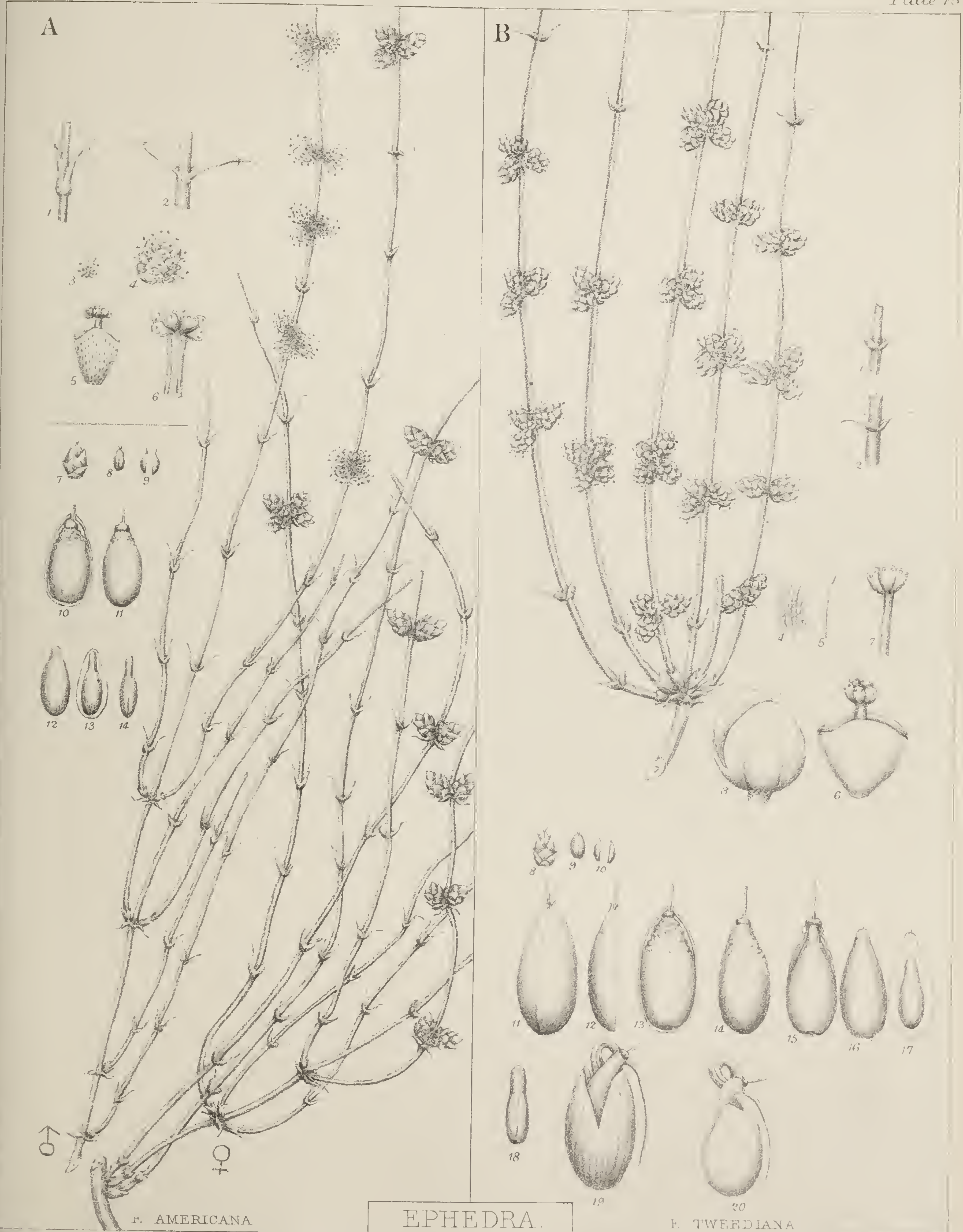
EPHEDRA

E. OCHREATA

J Miers, del

W West imp

Plate 78



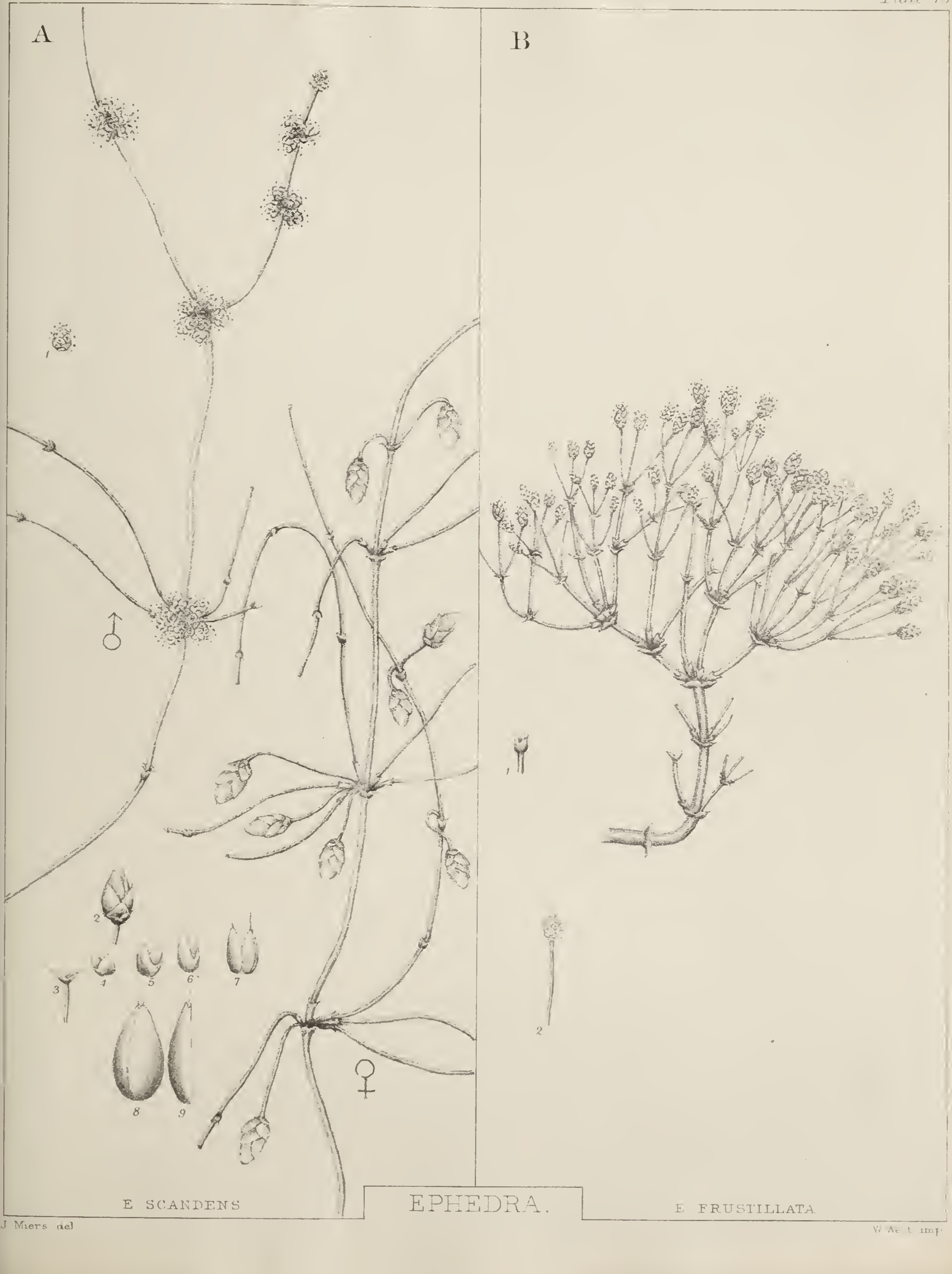
E. AMERICANA

EPHEDRA.

E. TWEEDIANA

W. West imp.

Plate 19



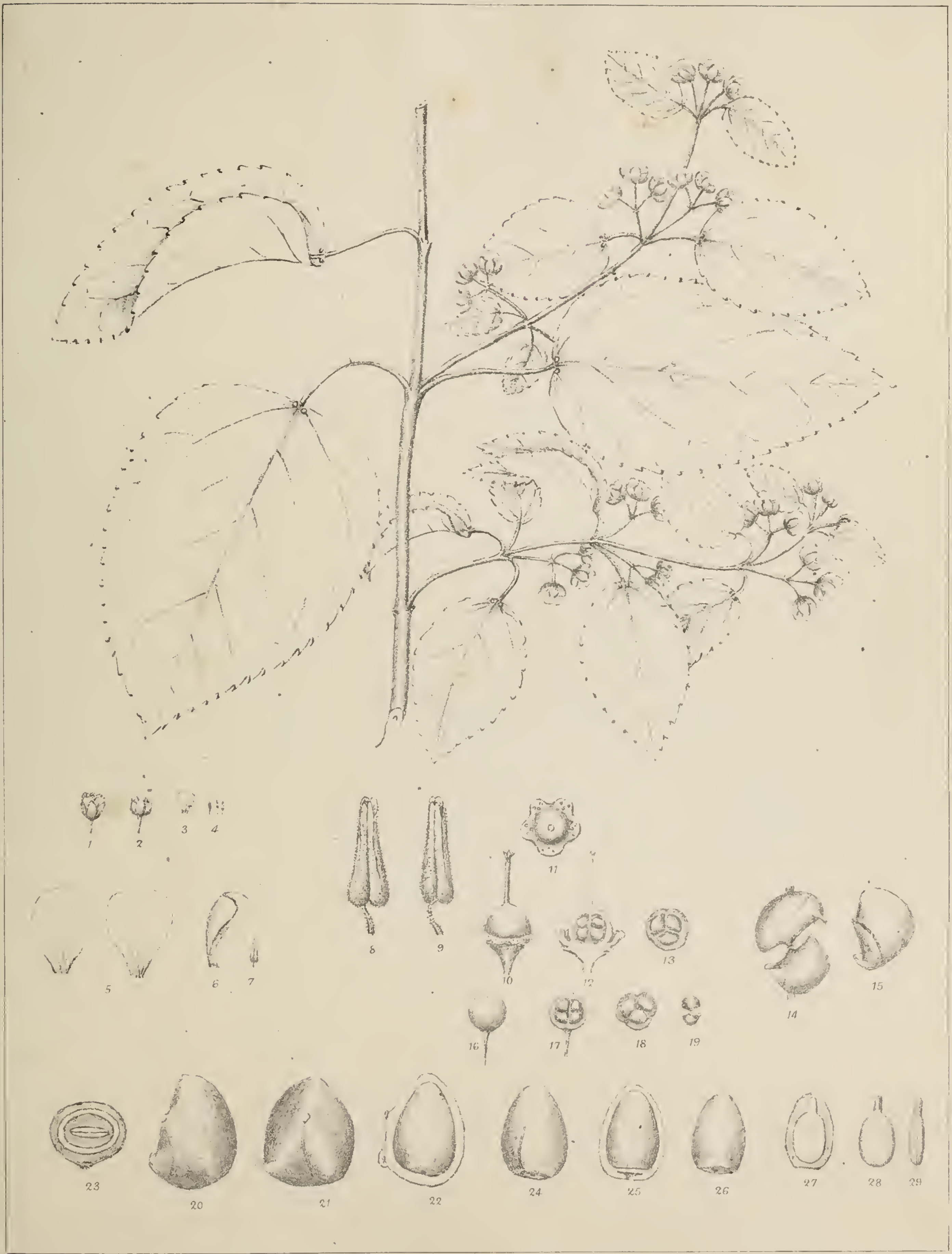
E SCANDENS

EPHEDRA.

E FRUSTILLATA

J Miers del

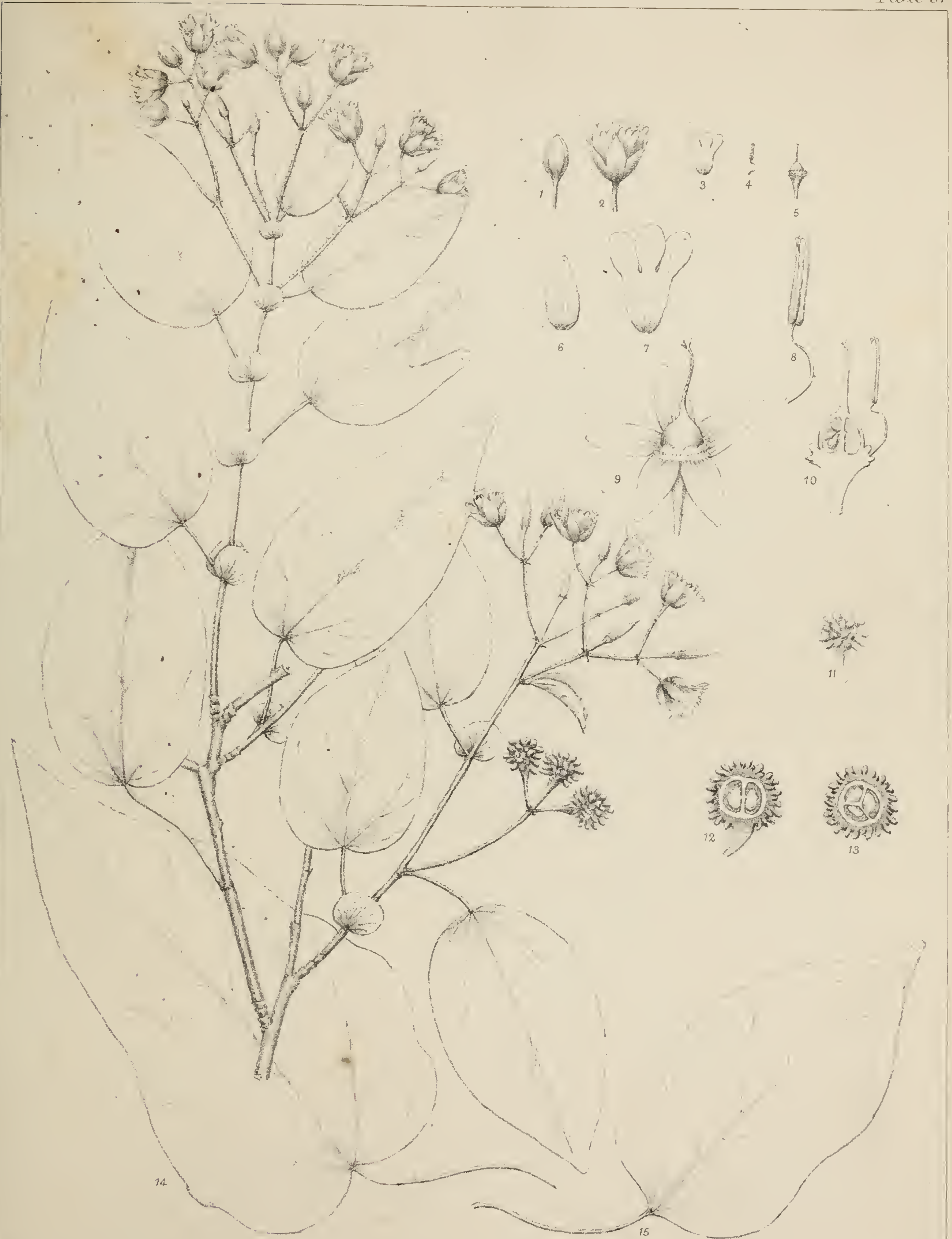
W. West imp.



J Miers del

W West imp

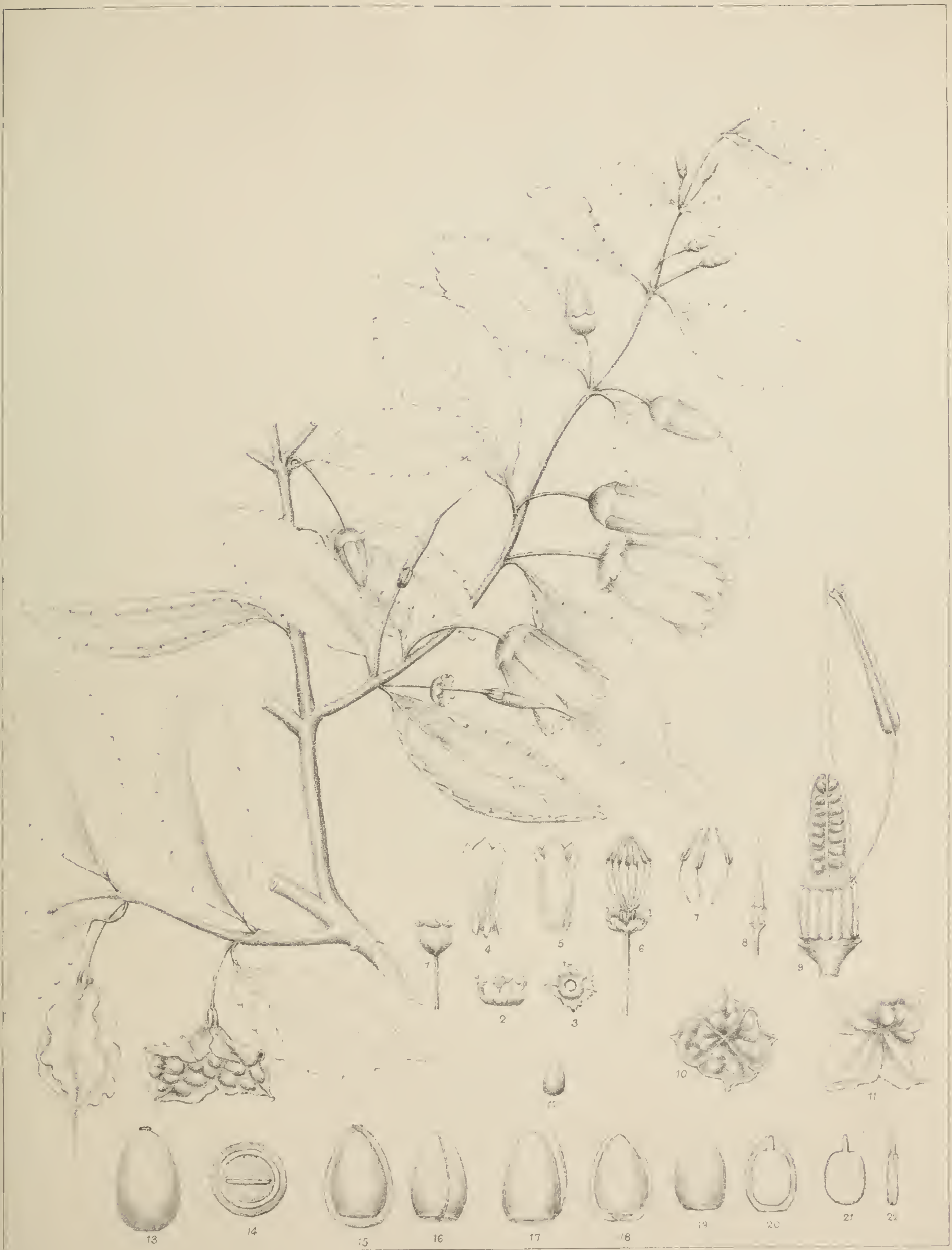
ARISTOTELIA MAQUI.



J Miers del

W West imp

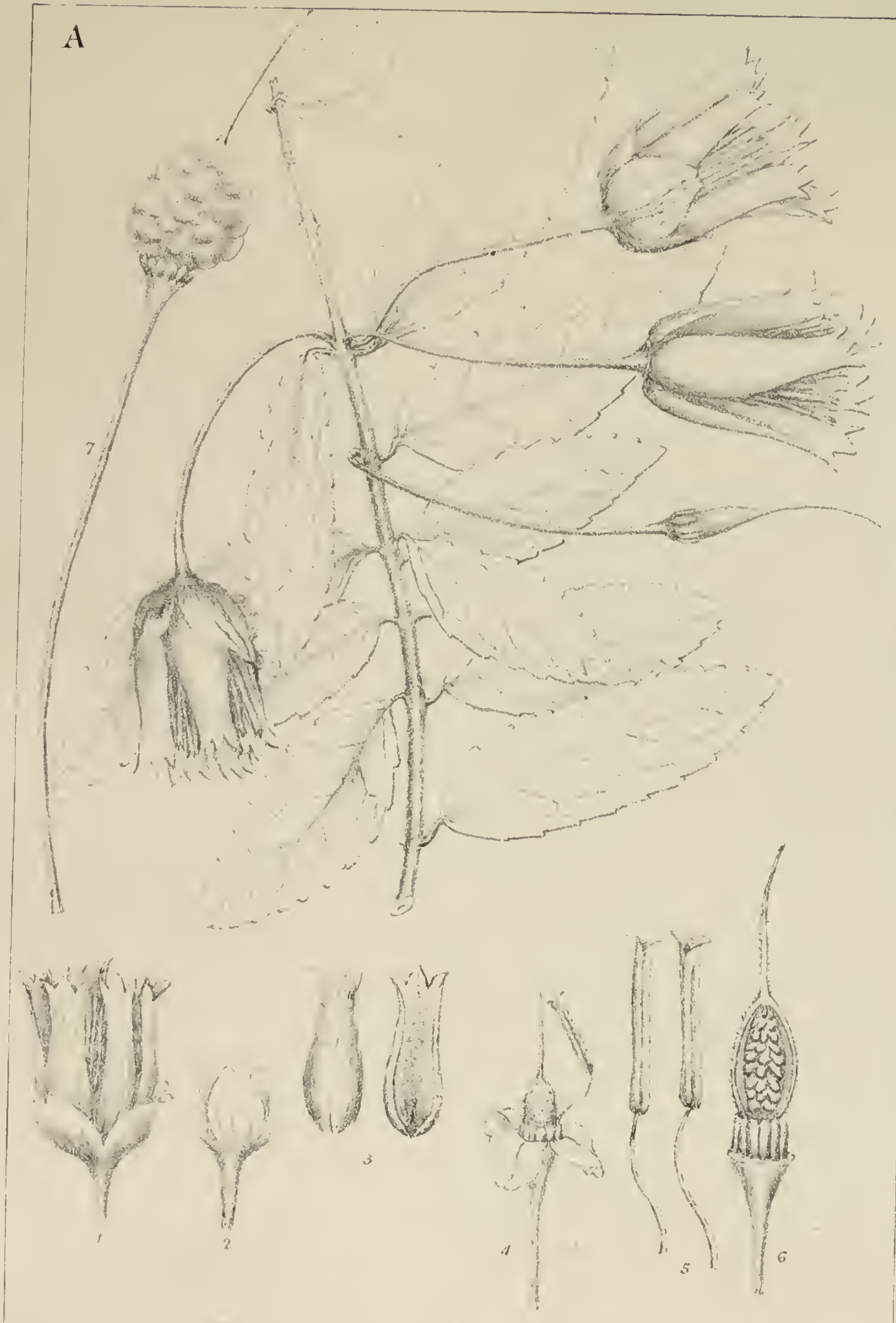
VALLEA PUBESCENS.



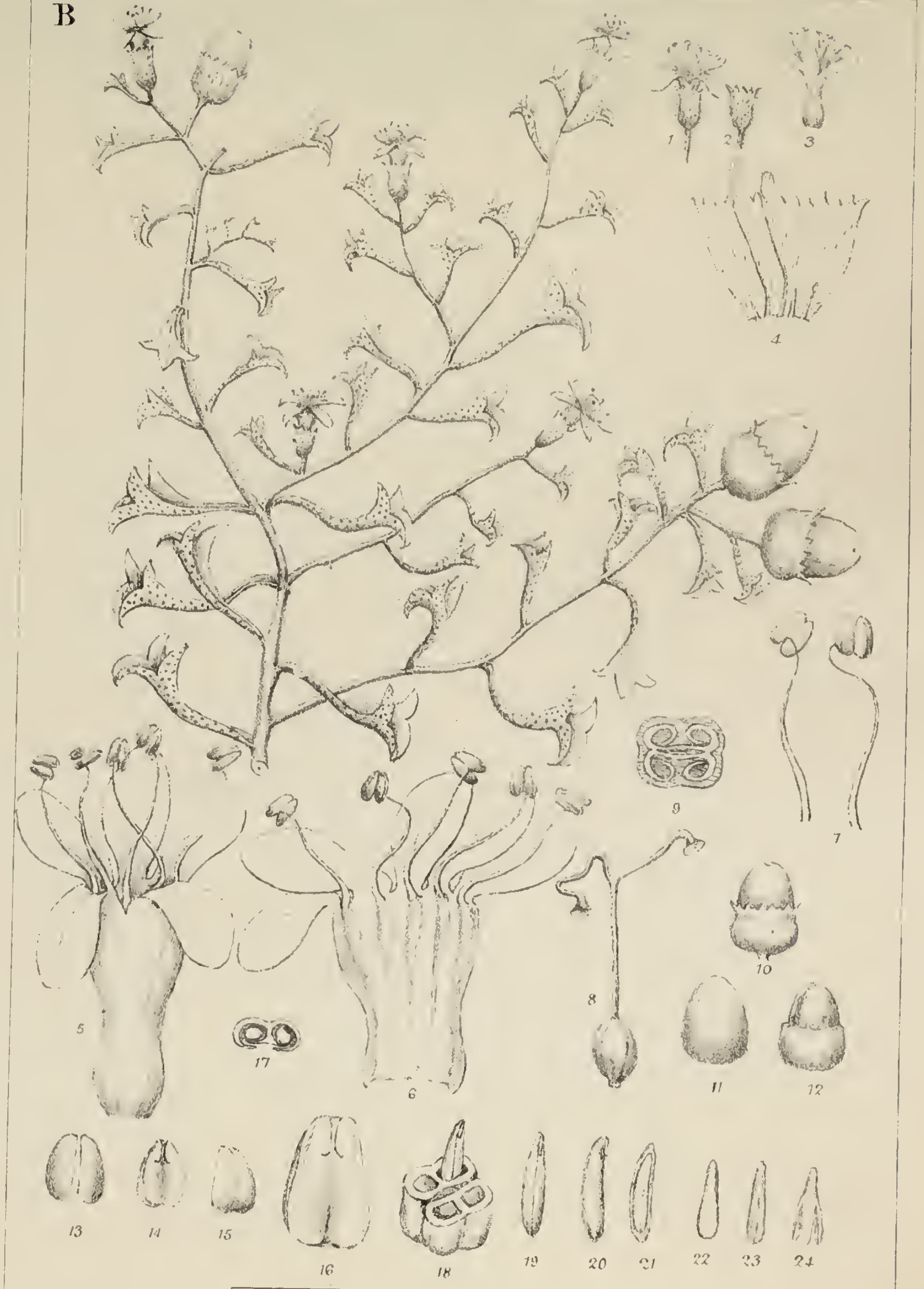
J Miers del

W West imp

TRICUSPIDARIA PATAGUA



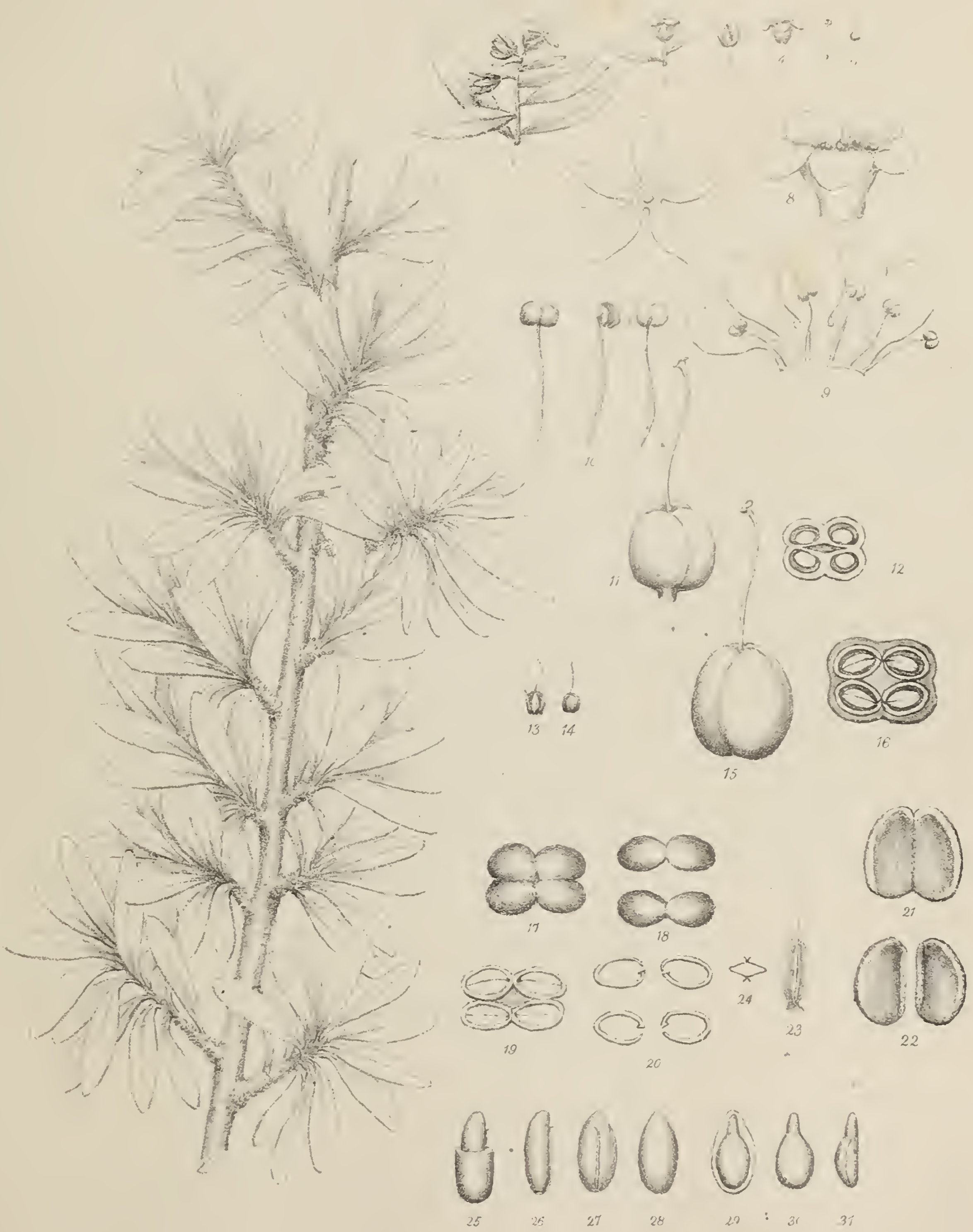
CRINODENDRON HOOKERIANUM



CORTESIA CUNEATA

Miers del.

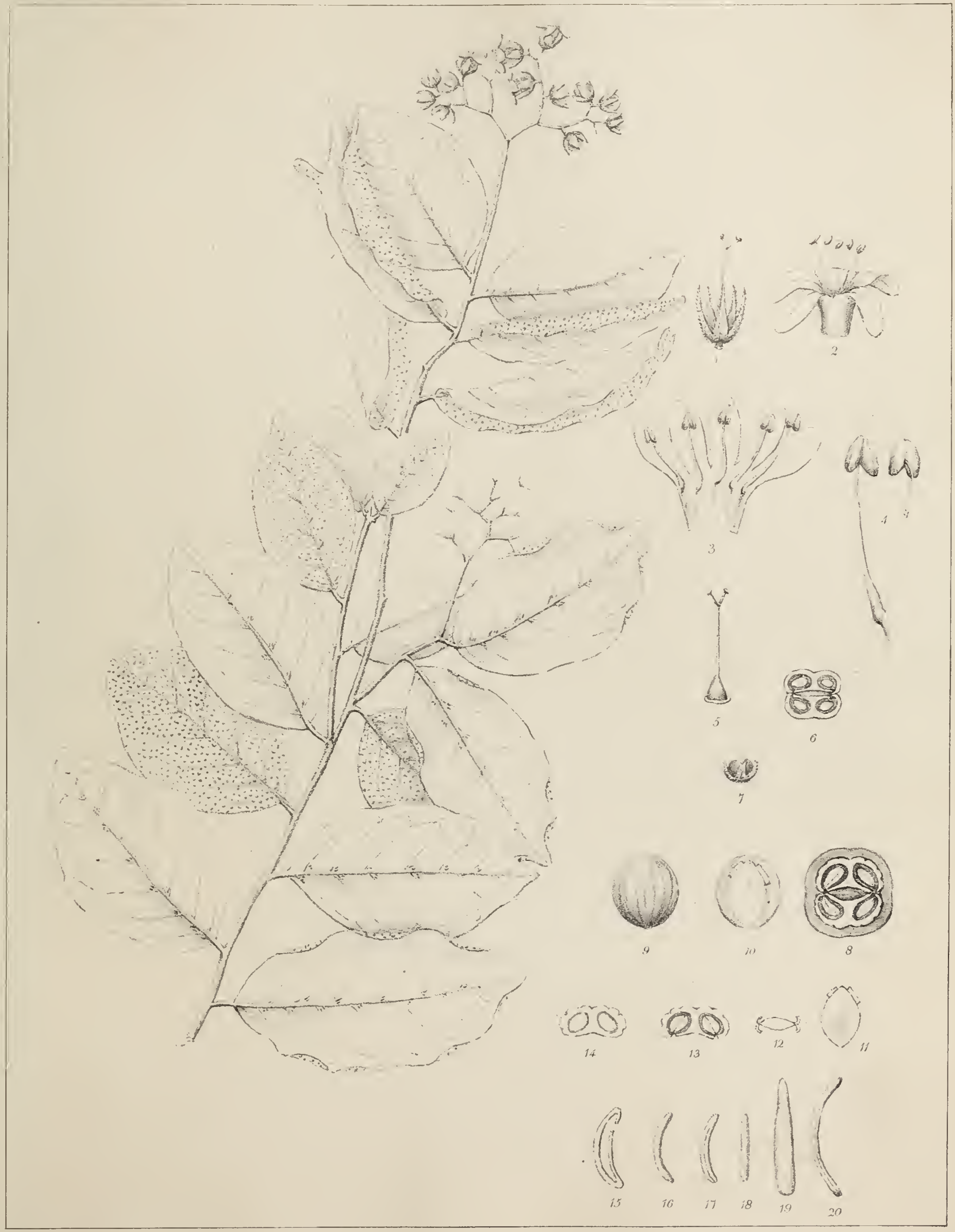
W West imp



J Miers del

W West imp

RHABDIA CREBRIFOLIA.

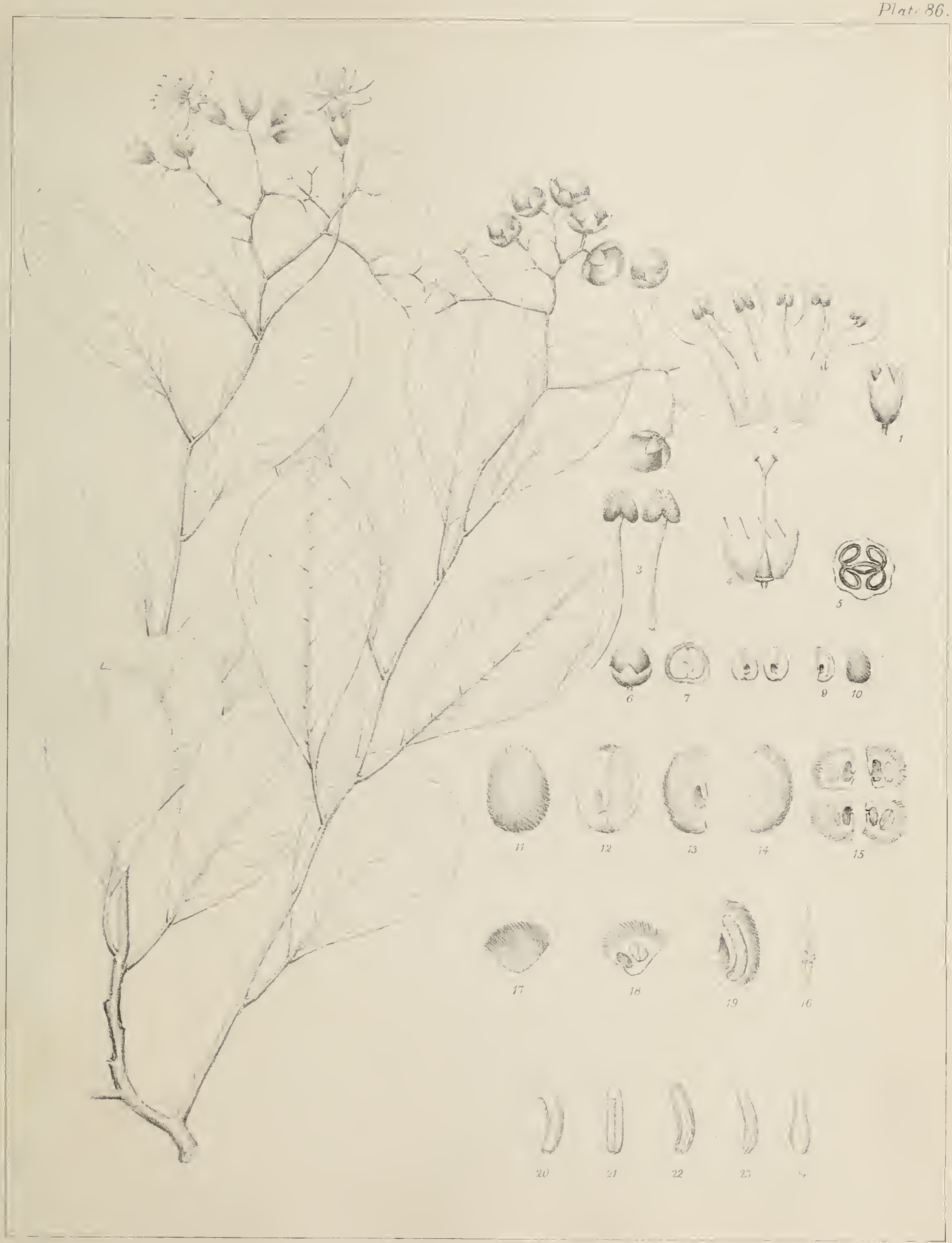


J Miers del

W. West imp

EHRETIA ELLIPTICA.

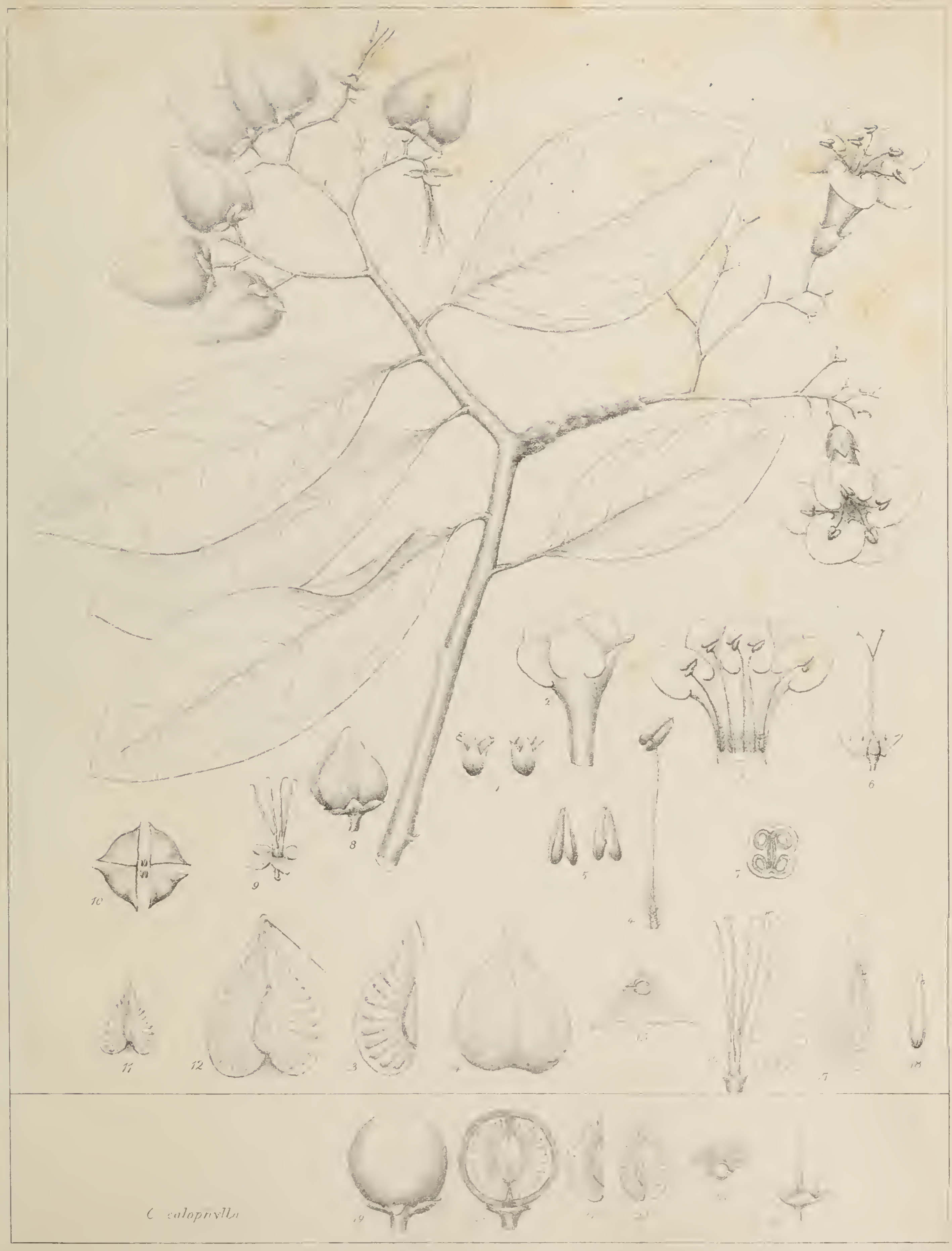
Plate 86.



J Miers d l

W West imp

BOURRERIA HAVANENSIS.



J Miers del

W West imp

CREMATOSMIA [illegible]

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25